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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 1
JANUARY 1, 1971

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Federal Water Quality Administration. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1954, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

SEA WATER,
Little (Arthur D.), Inc., Cambridge, Mass.
R. A. Horne.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 107-140, 1970. 134 p, 12 fig, 11 tab, 90 ref.

Descriptors: *Water chemistry, *Water structure, *Sea water, *Reviews, Saline water, Aqueous solutions, Solutes, Water properties, Absorption, Hydrogen ion concentration, Biological properties, Chemical properties, Electrolytes, Nutrients, Trace elements, Oxidation-reduction potential.
Identifiers: Sea water chemistry.

The structure and chemistry of sea water are reviewed. One of the most important recent advances in marine chemistry is the postulation of chemical equilibrium models. The concentrations of major constituents in the more important models are summarized. One of the most complex and certainly one of the most important equilibrium systems in the oceans is the carbonate system, which is fundamental not only to the hydrosphere but to the atmosphere, lithosphere and biosphere as well. This system is believed to maintain the pH of the oceans close to neutrality. Ocean water chemical systems are at least close enough to equilibrium to use equilibrium models. In the immediate neighborhood of the solute a hydration atmosphere is formed. Immediately adjacent to the sodium ion is its 'primary hydration' sheath of 4 strongly bound, tightly electrostricted water molecules. This is in turn surrounded by what is in essence a Frank-Wen cluster. Beyond the region of enhanced water structure is a zone of broken water structure where the Coulombic field is strong enough to disrupt the normal structure of liquid water but not enough to reorient the water molecules. Little is known about the hydration of anions but in general they are believed to be less heavily hydrated than cations. (Knapp-USGS)
W71-00008

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Warren H. Philipp, and Stanley J. Marsik.
Available from NTIS as NASA TN D-5880, $3.00 in paper copy, $0.95 in microfiche.National Aeronautics and Space Administration Technical Note, NASA TN D-5880, July 1970. 13 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Radioactivity techniques, *Chemical precipitation, Metals, Metallurgy, Aqueous solutions.
Identifiers: Radiochemistry.

Eleven metals, copper, zinc, cadmium, thallium, tin, lead, antimony, nickel, cobalt, iron, and palladium, were prepared from their aqueous salt solution by irradiation with 2-MeV electrons. In the more successful attempts, the metal yields nG (M) (atoms per 100 eV multiplied by the valence change n) averaged about 2. The yields have been interpreted in terms of the radical scavenging mechanism and the chemistry of the metal system involved. (Knapp-USGS)
W71-00040

02. WATER CYCLE

2A. General

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
Geological Society of America Bulletin, Vol 81, No 4, p 1243-1248, April 1970.6 p, 2 fig, 11 ref.

Descriptors: *Hydrogeology, *Geomorphology, *Surface-groundwater relationships, *North Carolina, Karst, Solubility, Recharge, Groundwater movement, Permeability, Transmissivity, Topography.
Identifiers: Comparative hydrogeology.

As a start toward needed classifications of hydrogeologic settings, a type of setting is described which includes areas where soluble materials are exposed to considerable recharge from precipitation and where both the topographic relief and permeability are small. Typical areas are (1) the Black Belt of the Coastal Plain of Alabama and Mississippi, underlain by chalk of the Selma Group, and (2) a 25-sq-mi area near Harrisburg, Cabarrus County, North Carolina, underlain by gabbro in the Piedmont province. Hydrologic conditions include: excessive evapotranspiration, low water-table gradient, water table near land surface, thin soils, very slow groundwater movement, groundwater movement mainly in the thin soil-rock contact zone, low base flow in streams, low drainage density, and subsurface water relatively high in dissolved mineral matter. Comparative hydrology represents a quick useful means of discerning the significance of processes and principles in particular environements. This setting reveals the significance of solution by subsurface water in developing some plains. Comparative hydrology allows an advanced analysis of some pertinent factors. (Knapp-USGS)
W71-00029

RAINFALL-RUNOFF RELATIONS FOR SOUTHWESTERN LOUISIANA,
Geological Survey, Baton Rouge, La.
F. N. Lee.
Louisiana Department of Public Works Technical Report No 2c, 1969. 91 p, 1 fig, 11 tab.

Descriptors: *Rainfall-runoff relationships, *Louisiana, Depth-area-duration analysis, Data collections, Hydrologic data, Regression analysis, Statistics, Gaging stations, Rain gages, Stream gages.
Identifiers: Southwestern Louisiana.

A method is given for estimating runoff from rainfall in southwestern Louisiana. Two distinct runoff areas are defined by a general exponential formula. Tables list values of the coefficients and exponents calculated for each of the two subareas. Differences in runoff from the two areas are attributed mainly to different soil characteristics. The standard errors of estimate, using all storms for the subareas are about 60% and 80%, respectively. However, as total amounts of runoff increase, the standard errors of estimate decrease. Rainfall, runoff, and storm duration data are tabulated for 1,351 storms analyzed at 37 streamflow stations and 63 rainfall stations. (Knapp-USGS)
W71-00059

PEAK FLOW AND CRITICAL DURATION FOR SMALL WATERSHEDS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W71-00061

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).
For primary bibliographic entry see Field 06A.
W71-00071

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
J. P. Riley, D. G. Chadwick, and E. K. Israelsen.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 25-37, 1968. 13 p, 9 fig, 11 ref.

Descriptors: *Simulation analysis, *Analog computers, *Hydrologic properties, *Watershed management, *Mathematical models, Water demand, Time, Utah.
Identifiers: Sevier River, Circle Valley.

The problem of the increasing need to assess the downstream consequences resulting from changes at specific locations in a hydrologic system was approached by use of electronic analog simulation. A model was developed for investigating the behavior or response of a dynamic prototype system subject to particular constraints and input functions. Simulation permitted an examination of the composite system involving all processes occurring simultaneously. Studies were undertaken for several watershed areas and involved different time and space increments. Presented were results obtained by simulating a subbasin of the Sevier River drainage in central Utah, referred to as Circle Valley and containing approximately 93,000 acres of mountain watershed and agricultural land. A hydrologic flow diagram was shown representing a basic hydrologic process expressed in mathematical terms. The computer model used synthesized these relationships into a working system. An analog flow chart for the model was also shown. Mean monthly outflow values for 1962 were computed and observed. Analog simulation of other watershed areas was also attempted. (See also W71-00071) (Kriss-Cornell)
W71-00072

ELECTRONIC ANALOG MODELING AS AN AID IN WATER RESOURCE INVESTIGATIONS,
Soil Conservation Service, Hyattsville, Md. Central Technical Unit.
For primary bibliographic entry see Field 06A.
W71-00404

INTERACTIONS OF THE BEACH-OCEAN-ATMOSPHERE SYSTEM AT VIRGINIA BEACH, VIRGINIA,
Army Coastal Engineering Research Center, Washington, D.C.
W. Harrison, and W. C. Krumbein.
Available from NTIS as AD-459 084, $3.00 in paper copy, $0.95 in microfiche. Technical Memerandum No. 7, December 1964. 110 p.
Identifiers: *Beaches, Physical properties, *Ocean waves, Wind, Atmosphere, Mathematical analysis, Virginia, Tidewater, Tides, Velocity, Ocean currents, Sedimentation, Interactions, Erosion, Programming (Computers), Least squares method., Air water interactions, Virginia Beach.

A number of interactions among beach variables are investigated by sequential linear multiregression analysis as programmed for high-speed computers. Study includes influence of beach geometry, wave characteristics, tidal effects, and local wind conditions on velocity of longshore currents, deposition and erosion on the lower forshore and response of grain size and beach slope to shore processes. Most-influential combinations of variables arbitrarily designated as 'process' variables are in general agreement with significant variables of wavetank experimentation, and substantiate intuitive judgments regarding relative importance of these variables on natural beaches. Results suggest that certain additional variables, seldom examined under controlled conditions, be studied in combination with variables normally examined in wave tanks. Time lag between inception of a group of 'processes' and moment of their maximum effect on the 'response' is also investigated.
W71-00468

2B. Precipitation

NEW DEVELOPMENTS IN ATMOSPHERIC WATER RESOURCES,
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.
For primary bibliographic entry see Field 03B.
W71-00006

ICE FORMATION BY CONTACT NUCLEATION,
State Univ. of New York, Albany.
For primary bibliographic entry see Field 02C.
W71-00032

OBSERVATIONS OF WATERSPOUTS AND THEIR PARENT CLOUDS,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
Vernon J. Rossow.
Available from NTIS as NASA TN D-5854, $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note, NASA TN D-5854, June 1970. 63 p, 24 fig, 1 tab, 58 ref. 2 append.

Descriptors: *Tornadoes, *Storms, Meteorology, Cloud physics, Storm structure, Weather patterns.
Identifiers: Waterspouts.

Waterspouts were studied during the summers of 1967 and 1968 in the area around Key West, Florida. Observations were made from Coast Guard Cutters and from aircraft. Measurements made of the electric and magnetic fields associated with these atmospheric vortices indicate that electricity does not play a primary role in their structure. Although electricity is eliminated as an essential or defining mechanism, some evidence was found (low cloud tops and a lightening demise of a spout) to indicate that these vortices cannot exist if electricity is too prominent. Of the 104 events sighted, it was found that 30 rotated cyclonically, 9 anticyclonically, and the rest either went unnoticed or were not observable. The parent clouds had tops at 8,000-12,000 ft and bottoms from 800-2,500 ft altitude. The mechanism responsible for the formation of the vortex at the time and location of its occurrence was not determined. The relationship to tornado structure is uncertain. (Knapp-USGS)
W71-00038

ORIGIN AND GEOMORPHOLOGY OF THE THAR DESERT,
Ranchi Univ. (India). Dept. of Geography.
Enayet Ahmed.
Annals of Arid Zone, Vol 8, No 2, p 171-180, September, 1969. 5 ref.

Descriptors: *Geomorphology, *Sands, *Arid lands, *Climatology, History, Geology, Wind erosion, Monsoons, Precipitation (Atmospheric), Weathering, Soil types, Deserts.
Identifiers: *India, *Thar Desert, Archaeology, Desert formation.

The Thar Desert is unique among world deserts because it does not fall in the lee of trade winds. Climatological factors cause the deflection of the southwest monsoons and there are no regional highlands that might cause relief rainfall. On the basis of archaeological finds of human settlements in prehistoric times, it has been theorized that the Thar Desert originated in post-Pleistocene times and that its extensive sand cover is derived by wind transport from the Rann of Kutch. The author argues that the Thar Desert is much older than the human species from the following considerations: (1) Nowhere else in the world are desert sands derived from coastal sands; (2) geological evidence for the existence of much earlier arid condtions; (3) lack of evidence of a shifting desert margin in modern times; (4) the physical impossibility of so much sand originating in the Rann of Kutch. Desert sand is largely quartz, and unlike soft minerals, is resistant to weathering. The strong winds carry away lighter, richer particles and the lack of water prevents clay and silt layering. (Casey-Arizona)
W71-00149

WATER BUDGET IN THE ARID ZONE OF RAJASTHAN DURING 1941-1960,
Central Arid Zone Research Inst., Jodhpur (India).
A. Krishnan, and K. P. Thanvi.
Annals of Arid Zone, Vol 8, No 2, p 291-299, September 1969. 3 fig, 4 tab, 10 ref.

Descriptors: *Arid lands, *Precipitation (Atmospheric), *Evapotranspiration, *Water balance, *Moisture deficit, Monsoons, Groundwater recharge, Soil moisture, Weather data, History, Variability.
Identifiers: India, *Thar Desert, *Rajasthan.

Records of 7 weather stations in arid west Rajasthan from 1941-1960 were analyzed in an attempt to elucidate year to year variability in the various components of water balance. Normally, all stations show a water deficit every month of the year, which decreases considerably during the monsoon season of July to October. During most years there is neither widespread drought nor excess precipitation and even in the wettest year moisture deficiency from January to monsoon onset was high. Generally, moisture surplus in excess of soil water capacity, effecting groundwater recharge, occurs only once in 20 years. (Casey-Arizona)
W71-00153

A STATISTICAL ANALYSIS OF THE RAINFALL OVER THE SUDAN,
Khartoum Univ. (Sudan). Dept. of Geography.
Mahdi Amin El-Tom.
Geographical Journal, Vol 135, No 3, p 378-387, 1969. 7 fig, 4 tab, 5 ref.

Descriptors: *Rainfall, *Climatology, *Monsoons, *Topography, Statistical methods, Regression analysis, Temperature.
Identifiers: *Sudan, *Inter Tropical Convergence Zone, *Latitude, *Line-squalls, Correlation coefficients, Longitudes, Residuals.

Rainfall is the outcome of a combination of many factors. A statistical analysis was made of 4 of these factors especially important in the Sudan. The 4 factors were transferred to equivalent spatial terms: (1) Inter Tropical Convergence Zone (ITCZ)-latitude, (2) relief-altitude, (3) monsoons--a distance and (4) line-squalls--longitudes east of Greenwich, since line-squall effects seem to change in relation to longitudes. A high negative correlation (-0.951) exists between annual rainfall and ITCZ and between the monsoonal factor and annual rainfall (-0.914). Regression lines of all 4 spatial factors on annual rainfall were calculated. All spatial factors, especially (1) and (3) were intercorrelated to some extent. The effect was eliminated by a partial regression analysis. The total annual percentage contribution of the 4 factors to rainfall was 92.76 with 90.48 being contributed by (1) alone. Residual patterns roughly follow longitudes, indicating that other factors, possibly local temperature, also effect Sudanese rainfall. (Casey-Arizona)
W71-00159

ESTIMATES OF EVAPORATION IN EAST AFRICA IN RELATION TO CLIMATOLOGICAL CLASSIFICATION,
East African Agriculture and Forestry Research Organization (Kenya).
For primary bibliographic entry see Field 02D.
W71-00160

ON THE POSSIBILITY OF WEATHER MODIFICATION BY AIRCRAFT CONTRAILS,
Alaska Univ., College. Geophysical Inst.
Wallace B. Murcray.
Monthly Weather Review, Vol 98, No 10, p 745-748, October 1970. 4 p, 11 ref. HEW Grants APOO 449-01, APOO 440-02, and APO 00449-03, NSF grant GA-19475.

Descriptors: *Clouds, *Aircraft, *Air pollution effects, *Cloud seeding, *Weather modification, Air pollution, Cloud physics, Chemistry of precipitation, Precipitation (Atmospheric).
Identifiers: Contrails, Ice fog.

The possible effect of contrails in modifying the weather is reconsidered in the light of information obtained from ground-level contrails in Alaska. It appears likely that inadvertent cloud seeding by jet aircraft may be of the same order of magnitude as that attained in commercial cloud seeding operations. Further investigation is needed; but in the meantime, the possibility of contrail contamination should be kept in mind when evaluating the results of seeding operations. (Knapp-USGS)
W71-00369

EFFECTS OF HURRICANES CAMILLE AND LAURIE ON THE BARATARIA BAY ESTUARY,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-00379

BEACH CHANGES BY EXTRAORDINARY WAVES CAUSED BY HURRICANE CAMILLE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W71-00380

EFFECTS OF HURRICANE CAMILLE ON THE LANDSCAPE OF THE BRETON-CHANDELEUR ISLAND CHAIN AND THE EASTERN PORTION OF THE LOWER MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W71-00381

METEOROLOGICAL ASPECTS OF HURRICANE CAMILLE--AUGUST 14-22, 1969,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Shih-Ang Hsu.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 5-11, February 1970. 7 p, 1 fig, 1 tab, 2 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Storm structure, *Louisiana, *Appalachian Mountain region, *Hurricanes, Meteorology, Data collections, Meteorological data, Cata collections, Atmospheric pressure, Rainfall, Wind velocity.
Identifiers: Hurricane camille (1969).
W71-00382

SULFUR: SIMULATED LONG-RANGE TRANSPORT IN THE ATMOSPHERE,
Battelle Memorial Inst., Seattle, Wash.
For primary bibliographic entry see Field 05B.
W71-00385

AIR POLLUTION SURVEILLANCE SYSTEMS,
National Air Pollution Control Administration, Cincinnati, Ohio. Bureau of Criteria and Standards.
For primary bibliographic entry see Field 05B.
W71-00394

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering; and Auburn Univ., Ala. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 08B.

W71-00405

PREDICTING PRECIPITATION TYPES,
Weather Bureau, Salt Lake City, Utah. Western Region.
Robert J. C. Burnash, and Floyd E. Hug.
Available from NTIS as PB-190 962, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum WR-49, March 1970. 12 p.
Identifiers: *Atmospheric precipitation, *Weather forecasting, Snow, Rainfall, Ice, Radiosondes, Surface properties, Dew point, Classification, Heat transfer, Atmospheric sounding, Cooling, Utah.

The report discusses possibilities of distinguishing precipitation types. The fact that California's primary snow areas are located at a considerable distance from radiosonde stations made it necessary to place two data requirements on cases to be analyzed: (1) The wind direction at a radiosonde station must be stable enough to indicate air mass characteristics that would be advected to a definable sector of the precipitation area. (2) Information from the precipitation area must be adequate to determine the level at which snow changes to rain. A study of data for the period 1955-1967 inclusive meeting these requirements led to selection of two primary criteria which would be useful in predicting the level at which snow would change to rain. Depth of the moist layer colder than zero degrees Celsius, and heat required to convert falling snow to rain.
W71-00451

TECHNIQUES FOR FORECASTING LOW WATER OCCURENCES AT BALTIMORE AND NORFOLK,
Weather Bureau, Silver Spring, Md. Techniques Development Lab.
James M. McClelland.
Available from NTIS as PB-191 744, $3.00 in paper copy, $0.95 in microfiche. ESSA Technical Memorandum WBTM TDL 28, March, 1970. 43 p.
Identifiers: *Harbors, Shipping (Marine), *Tides, Weather forecasting, Regression analysis, Barometric pressure, Meteorological charts, Ships (Nonmilitary), Chesapeake Bay, Baltimore (Maryland), Norfolk (Virginia), Air water interactions.

The report describes the development of manual techniques for forecasting low water occurrences at Baltimore and Norfolk. Each technique is based on a regression equation, derived by the multiple correlation-screening process, which requires certain surface wind and pressure data from three Chesapeake Bay stations. The minimum and maximum time lags for each equation are 6 and 24 hours, respectively. Tests on independent data from Baltimore and Norfolk show root-mean-square errors of 0.6 feet and 0.4 feet, respectively. These techniques can be useful forecast aids when used under synoptic conditions favorable for low water occurrences.
W71-00467

2C. Snow, Ice, and Frost

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
Bernard Michel.
U S Army Corps of Engineers Cold Regions Research and Engineering Laboratory Science and Engineering Monograph III-B1b, June 1970. 71 p, 39 fig, 10 tab, 79 ref. Project DA 1T062112A130.

Descriptors: *Ice loads, *Hydraulic structures, *Reviews, *Bibliographies, Ice, Ice jams, Reservoirs, Dams, Pressure, Loads (Forces), Engineering structures.
Identifiers: Ice pressure.

One of the most important forces in the design of a dam in northern regions is the horizontal thrust applied to the structure by a solid sheet of ice. There have been few reported dam failures caused by ice pressure and some engineers have doubted the advisability of making substantial allowances for this pressure in the design of hydraulic structures. But measurements made during the last few years leave no doubt as to its importance. Extensive measurements were made from 1946 to 1951 at several reservoirs in the mountains of Colorado. Indenter and strain gages were set in thin mortar panels that could be installed on the face of the walls and at sites exposed to ice thrust. The maximum measured ice pressure at Eleven Mile Canyon was 16 kips/ft in 1947-48, 14 kips/ft in 1948-49 and 20 kips/ft in 1949-50. The highest thrust of all, 17 kips/ft, was recorded at Tarryall Reservoir which has steep rocky shores in the vicinity of the dam. This monograph summarizes and reviews existing knowledge on forces exerted by an expanding ice sheet, impact forces of ice on structures, and vertical forces exerted by ice on hydraulic structures. Sections are also devoted to icebreakers and ice models. A bibliography of 79 entries is included. (Knapp-USGS)
W71-00012

ICE FORMATION BY CONTACT NUCLEATION,
State Univ. of New York, Albany.
Narayan R. Gokhale.
New York State University at Albany Scientific Report, June 1970. 54 p, 20 fig, 19 ref, 4 append.NSF Grants GA328 and GA839.

Descriptors: *Nucleation, *Freezing, *Cloud seeding, *Chemistry of precipitation, Condensation, Particle size, Silver iodide, Laboratory tests.
Identifiers: Contact nucleation.

An investigation of the phenomenon of ice nucleation in water drops due to contact by dry particles at their surfaces was made by observing and photographing the freezing of a large number of water drops. Particles are much more effective in freezing water drops by contact at their surfaces than when they are embedded in the drops. The shift toward warmer temperatures is in the range of 5 to 10C depending on the material. Particles have considerably higher effect on nucleating water drops which are supercooled before the particles land on the surface, than the drops which are not supercooled. The effective degree of supercooling of drops for silver iodide is -5C and for silicate material -8C. Among the materials tested, AgI particles are the most effective in contact nucleation. This shows that a surface structure of the particle similar to that of ice from the point of view of crystal symmetry, and lattice dimensions seems to be important in this mechanism. The freezing is initiated by the particle at the point of contact on the surface of a drop. The surface film freezes first and then the interior of the drop freezes. The best results are obtained in freezing freely suspended millimeter-size water drops in clouds by contact nucleation if silver iodide particles are introduced in the region where the degree of supercooling is at least -5C. (Knapp-USGS)
W71-00032

DYNAMIC YOUNG'S MODULUS AND FLEXURAL STRENGTH OF SEA ICE,
Army Terrestrial Sciences Center, Hanover, N.H.
Guenther E. Frankenstein, and Robert Garner.
Army Cold Regions Research and Engineering Laboratory Technical Report 222, May 1970. 14 p, 4 fig, 2 tab, 10 ref, .append. DA Task No 1T062112A13001.

Descriptors: *Sea ice, *Youngs modulus, *Shear strength, *Elastic deformation, *Deflection, Strength of materials, Elastic theory, Tensile strength, Deformation, Elasticity (Mechanical).
Identifiers: Elastic properties (Ice).

Tests were made to determine the dynamic Young's modulus of sea ice. The ice samples were mainly parallelepipeds but a few were 7.62-cm-diam cores. The longitudinal wave velocity (a function of Young's modulus) was determined by measuring the time required for a sound wave to travel the length of the sample. The measured wave velocities were corrected, by Love's frequency equation, to apply for infinite wavelengths. The flexural strength of the ice was determined by conducting a number of simple beam tests. The average value for the flexural strength was 11.3 kg/sq cm. (Knapp-USGS)
W71-00043

PHASE BOUNDARY WATER IN FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02G.
W71-00044

DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
K. A. Linell, and C. W. Kaplar.
Army Materiel Command Cold Regions Research and Engineering Laboratory Technical Report 150, August 1966. 12 p, 7 fig.

Descriptors: *Frozen soils, *Soil classifications, *Permafrost, Soil physical properties, Freezing, Thawing, Soil water, Ice, Soil chemical properties.
Identifiers: Frozen soil classification.

The description and classification of frozen soils is presented as an extension of the Unified Soil Classification System adopted by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation in 1952. Descriptions, based on physical appearance, are nongenetic and are applicable to both naturally and artificially frozen soils. Field identification data pertaining to frozen soils and those pertinent properties of frozen materials which can be measured by physical tests are indicated. Also, guides are presented for construction on soils subject to freezing and thawing. The report includes photographic illustrations of frozen soil types; a chart showing relationships between unit dry weight of soil, water content, and ice volume; and an example of graphical presentation of frozen soil data. (Knapp-USGS)
W71-00068

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00373

STUDIES OF MORPHOLOGY AND STREAM ACTION ON ABLATING ICE. PART I. MORPHOLOGY AND STRUCTURE OF AN ICE-CORED MEDIAL MORAINE, KASKAWULSH GLACIER YUKON,
Arctic Inst. of North America, Washington, D.C.
S. R. Loomis.
Available from NTIS as AD-709 616, $3.00 in paper copy, $0.95 in microfiche. Arctic Institute of North America, Research Paper No. 57, Wash. D.C. January 1970. 167 p. Army Research Office Support.
Identifiers: *Glaciers, Yukon Territory, Ice, Ablation, Structural properties, Rock (Geology), Fluid flow, Transport properties, Surface, Friction, Thickness, Meeting, Terrain, Inland waterways, Snow, Gravel, Deposits, Soils, *Kaskawulsh glacier (Yukon Territory), Stream morphology, Moraines, Lithology, Topographic profiles.

Part I, 'Morphology and Structure of an Ice-Cored Medial Moraine, Kaskawulsh Glacier, Yukon, describes morphological and lithological characteristics of a medial moraine and their relationship to ablation and flow processes on Kaskawulsh Glacier. Part II, 'Channel Adjustments and Supraglacial Streams,' describes the seasonal evolution of a supraglacial stream in terms of stream morphology and energy exchange on the Capps Glacier. Part III, 'Supraglacial Streams on the Kaskawulsh Glacier, Yukon Territory,' classifies supraglacial streams on

the Kaskawulsh Glacier in relation to structure, morphology, bet material, and seasonal processes.
W71-00442

PHASE BOUNDARY WATER IN FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Duwayne M. Anderson.
Available from NTIS as AD-706 840, $3.00 in paper copy, $0.95 in microfiche. Research Report 274, May 1970. 24 p, 8 fig, 41 ref.
Identifiers: *Arctic regions, Soils, *Soils, Water, Freezing, Melting, Interfaces, Ice, Silicates, Air, Heat transfer, Montmorillonite, Remote areas.

It is now widely recognized that water a phase boundaries plays an important and in some cases the dominant role governing heat and mass transport, electrical conduction, transmission of compression waves and other processes of importance in frozen soils. There is also an increasing recognition of the contrast between the complexity of the phenomenology of freezing and thawing and the crudeness of the concepts and models that so far have been available. This report summarizes presently accepted concepts and information and sketches an area where significant advances in knowledge are to be expected.
W71-00462

THERMAL ANALYSIS OF ABOVE-GROUND LIQUID DISTRIBUTION SYSTEMS (UTILIDORS) FOR POLAR APPLICATION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 08A.
W71-00465

2D. Evaporation and Transpiration

IMPLICATIONS OF A TYPE OF EMPIRICAL EVAPORATION FORMULA FOR LAKES AND PANS,
Cornell Univ., Ithaca, N.Y.
Wilfried Brutsaert, and Gour-Tsyh Yeh.
Research supported by Federal Water Pollution Control Administration.Water Resources Research, Vol 6, No 4, p 1202-1208, August 1970. 7 p, 1 fig, 22 ref.

Descriptors: *Evaporation, *Equations, *Mass transfer, *Evaporation pans, Mathematical models, Lakes, Winds, Advection, Turbulence, Diffusion, Reservoir evaporation, Water temperature.
Identifiers: Lake evaporation.

Empirical mass transfer formulas for evaporation from lakes and from pans at ground level are compared with the theoretical solution based on semiempirical turbulent diffusion theory in conjunction with Reynolds analogy and the power law for the wind profile. It was found that although the theory has its limitations, it is a useful tool for the study of evaporation, especially under conditions of lateral advection. The empirical formulas should be adequate for many design problems. (Knapp-USGS)
W71-00024

ESTIMATES OF EVAPORATION IN EAST AFRICA IN RELATION TO CLIMATOLOGICAL CLASSIFICATION,
East African Agriculture and Forestry Research Organization (Kenya).
M. Dagg, and J. R. Blackie.
Geographical Journal, Vol 136, No 2, p 227-234, 1970. 3 fig, 3 tab, 18 ref.

Descriptors: *Evapotranspiration, *Climatology, *Solar radiation, *Evaporation, Semiarid climates, Seasonal, Temperature, Land use, Water balance, Water consumption (Excludes consumptive use), Evaporation pans, Climatic data.
Identifiers: Pans, Thornthwaite climatological classifications, Africa, Equatorial conditions.

Accurate climatological classification is important in underdeveloped lands in order to facilitate realistic planning for agricultural development. The water balance of a forested catchment area at Kericho, Kenya, was measured over a period of 8 years (1958-1968) and evapotranspiration was compared to those calculated from various climatic classification theories. The Thornthwaite and Olivier methods considerably underestimated evaporation while the class 'A' pan and Penman methods not only closely agreed with measurements but also showed a realistic seasonal variation. It is argued that the greater accuracy of Penman's methods over others was due to the use of radiation data which are less conservative than temperature data and more appropriate to equatorial climatic conditions. In drier arid regions evaporation may be little related to evapotranspiration from well water transpiration surfaces. Using Thornthwaite's evaporation estimates, the area was classified Humid B2. With Penman's data, classification is dry sub-humid C1 and is probably more useful to land-use planners. (Casey-Arizona)
W71-00160

EFFECT OF WATER-TABLE LEVELS ON EVAPOTRANSPIRATION AND CROP YIELD,
Agricultural Research Service, Raleigh, N.C. Soil and Water Div.
R. E. Williamson, and John R. Carreker.
Americal Society Africultural Engineers Transactions, Vol 13, No 2, p 168-170, March-April 1970. 3 p, 4 fig, 5 tab.

Descriptors: *Evapotranspiration, *Model studies, Rainfall, Soils, Water table, Crops.
Identifiers: *Water-table levels, *Crop yield, Soil tanks.

Crops were grown in soil tanks with different depths to the water table in 1959 to 1964, inclusive. Six tanks were without shelters and subjected to rainfall, and 48 tanks were protected from rain by rain-controlled, electrically operated shelters. Surface soils used in these tanks were Norfolk fine sandy loam in the nonsheltered tanks, fine sandy loam in 20 sheltered tanks, and Bayboro loam in 28 sheltered tanks. No attempt was made to reconstruct the soil profiles. These soils were adjusted initially to pH 6.0 with dolomitic limestone. Fertilizer and lime were mixed into the top 6 in. each year. Salt content was monitored and the sheltered tanks were leached as necessary to prevent a buildup of salts. Water-table levels were established 2 to 3 weeks after crops were planted. The depths to water were 6, 18, and 30 in. in the nonsheltered tanks and 6, 12, 18, 24 and 30 in. in the sheltered tanks 3 ft. deep. Additional levels of 36 and 40 in. were maintained in the sheltered tanks 4 feet deep. Daily rates of evapotranspiration in the sheltered tanks generally were slightly higher for the 12-in. depth to water table than for the 6-in. depth. The rate then tended to decline as depth increased with most crops. Tables and curves relating rainfall, water tables, soils, and crops to evapotranspiration are presented. (Woodard-USGS)
W71-00219

STOCHASTIC ASPECTS OF LAKE ONTARIO EVAPORATION,
Rutgers - The State Univ., New Brunswick, N.J.
Shaw L. Yu, and Wilfried Brutsaert.
Water Resources Research, Vol 5, No 6, Dec 1969. p 1256-1266, 7 fig, 5 tab, 13 ref.

Descriptors: *Lake Ontario, *Evaporation, *Stochastic processes, *Meteorology, *Correlation analysis, Wind velocity, Markov processes, Air temperature, Lakes.
Identifiers: Water budget.

Time series analysis was carried out on long-term monthly mean values of evaporation from Lake Ontario, which were generated in an earlier study, and on related meteorologic parameters. Correlation and spectral analyses showed that the annual cycle was dominant in all the time series. Evaporation is usually high in autumn and winter and low in spring and summer. A warming trend was observed in the air temperature and a drying trend in the relative humidity series. Except for the wind speed, no significant trend was found for the other time series. Cross correlation and cross-spectral analyses showed a close relationship between evaporation anomalies and the anomalies of the other parameters. A first order Markov model adequately described the evaporation, air temperature, and relative humidity anomalies, whereas a second order model fitted the anomalies of wind speed and water surface temperature. Morton's (1967) water budget method yields higher evaporation estimates in the summer and lower estimates in the winter than the mass transfer estimates. (Upadhyaya-Vanderbilt)
W71-00233

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Menlo Park, Calif.
C. D. Ripple, J. Rubin, and T. E. A. van Hylckama.
Geological Survey, Open-file report, 1970. 62 p, 10 fig, 28 ref, append.

Descriptors: *Evaporation, *Soil water movement, *Groundwater movement, *Air-earth interfaces, Water table, Humidity, Temperature, Mass transfer, Meteorology, Hydraulic conductivity.
Identifiers: Evaporation from bare soil.

A procedure that combines meteorological and soil equations of water transfer makes it possible to estimate approximately the steady-state evaporation from bare soils under conditions of high water table. Field data required include soil-water retention curves, water table depth and a record of air temperature, air humidity and wind velocity at one elevation. The procedure takes into account the relevant atmospheric factors and the soil's capability to conduct water in liquid and vapor forms. It neglects the effects of thermal transfer (except in the vapor case) and of salt accumulation. Homogeneous as well as layered soils can be treated. Results obtained with the method demonstrate how the soil evaporation rates depend on potential evaporation, water table depth, vapor transfer and certain soild parameters. (Knapp-USGS)
W71-00370

EVAPOTRANSPIRATION AS AFFECTED BU PLANT DENSITY AND WATER-TABLE DEPTH,
Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab.
E. H. Stewart, J. E. Browning, and E. O. Burt.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 646-647, September-October 1969. 2 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Evapotranspiration, *Soil-water-plant relationships, *Vegetation effects, *Water table, Model studies, Rainfall, Soil structure, Lysimeters, Irrigation effects.
Identifiers: Evapotranspirometers.

Evapotranspiration data from Tifway bermudagrass were obtained with nonweighing evapotranspirometers at the Plantation Field Laboratory near Fort Lauderdale, Fla. The installations consist of 12 waterproof rectangular concrete tanks, 5 ft deep, each having a plot area of approximately 1/1,000 acre. The soil was removed from excavation site and replaced inside and outside the tanks in approximately 1-ft layers to reconstruct the original soil profile as closely as possible. Relationships were linear between degree of plant cover and annual evapotranspiration of Tifway bermudagrass grown on Arzel fine sand with 12-, 24-, and 36-inch water tables. Evapotranspiration increased with sod cover at water-table depths of 24 and 36 inches, but decreased slightly with cover for the water-table depth of 12 inches. The ratio between evapotranspiration from no sod or a partial sod and a full sod was related to the depth to water table

and the amount, frequency, and distribution of rainfall. Graphs, tables of data, and a picture of the model are included. (Woodard-USGS)
W71-00402

2E. Streamflow and Runoff

EFFECTS OF DENSITY DIFFERENCES ON LATERAL MIXING IN OPEN-CHANNEL FLOWS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
For primary bibliographic entry see Field 05B.
W71-00005

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.
For primary bibliographic entry see Field 06B.
W71-00010

COMPILATION OF HYDROLOGIC DATA, ESCONDIDO CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of report may be obtained at U S Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 73 p, 2 fig, 3 tab.

Descriptors: *Rainfall, *Runoff, *Streamflow, *Texas, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Escondido Creek (Kenedy, Texas), Weighted-precipitation record, Inflow and outflow computation.

This report contains rainfall and runoff data collected during the 1968 water year (October 1967 to September 1968) for the 72.4 square-mile area above stream-gaging station Escondido Creek at Kenedy, Texas. Monthly and yearly rainfall and runoff data from 1954 to 1968 are included. The location of floodwater-retarding structures and hydrologic instruments in the area are shown. Current objectives of the study are to determine the net effect of floodwater-retarding structures on the regimen of streamflow at downstream points; to develop computation techniques that will provide more accurate estimates of runoff resulting from a given amount of rainfall on small watersheds; to develop relationships between maximum rates of runoff and rainfall in small watersheds that will enable more accurate design of small storm-drainage structures; and to determine the minimum instrumentation necessary to make reliable estimates of total storm inflow to the structures. (Woodard-USGS)
W71-00013

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02A.
W71-00029

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 04A.
W71-00033

CIRCULATION, EFFLUENT DIFFUSION, AND SEDIMENT TRANSPORT, MOUTH OF SOUTH PASS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 05B.
W71-00036

COMPILATION OF HYDROLOGIC DATA, AUSTIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of this report may be obtained at US Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 68 p, 3 fig, 1 tab.

Descriptors: *Streamflow, *Discharge measurement, *Urbanization, *Texas, Rainfall, Runoff, Stream gages, Peak discharge, Low flow, Average flow.
Identifiers: *Waller Creek watershed (Austin, Texas), *Wilbarger Creek watershed (Travis County, Texas).

Rainfall and runoff data compiled in this report for the 1968 water year (October 1967 to September 1968) from the urban Waller Creek watershed in Austin, Texas and the rural Wilbarger Creek watershed in Travis County are primarily for comparative purposes in determining the effects of existing and progressive urbanization in the Waller Creek watershed. Also included are average stream discharge values, discharge extremes, and weighted-mean rainfall data for several years of record in both watersheds. (Woodard-USGS)
W71-00041

A STUDY OF STREAM BEHAVIOR IN THE CANTERBURY FOOTHILLS, NEW ZEALAND,
New Zealand Forest Service, Wellington. Forest Service Inst.
Hans M. Keller.
New Zealand Ministry of Works--Water and Soil Division Miscellaneous Hydrological Publication No 3, 1970. 15 p, 7 fig, 7 tab, 14 ref.

Descriptors: *Streamflow, *Stream erosion, *Geomorphology, Drainage patterns (Geologic), Vegetation effects, Geology, Rainfall-runoff relationships, Topography, Alluvial channels, Erosion.
Identifiers: *New Zealand.

The streamflow and geomorphology of a catchment with an area of 7.42 square miles in the Canterbury foothills, New Zealand, was studied. Analyses of topographical maps and aerial photographs were used, as well as field surveys of the stream bed, side slopes, and flow conditions. Hypsometric, intercepting-surface, and stream-profile analyses were adequate to obtain a quantitative measurement of permanent characteristics and, in turn, to allow a direct comparison of the 2 main branches and the 2 subcatchments. Of other surveys and analyses, those of side-slope conditions, detailed sections of longitudinal profile, streamflow comparisons (using conductivity measurements), and vegetational establishment on gravel terraces appeared promising for comparative studies. (Knapp-USGS)
W71-00042

COMPILATION OF HYDROLOGIC DATA, MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of report may be obtained at US Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas, 78701. Geological Survey Open-file report, 1970. 9 p, 1 fig.

Descriptors: *Streamflow, *Discharge measurement, *Stream gages, *Texas, Peak discharge, Low flow, Average flow, Rainfall.
Identifiers: *Mountain Creek watershed (Texas).

Compiled in this report are streamflow and reservoir-content data collected in the Mountain Creek watershed, Texas, during the 1968 water year (October 1967 to September 1968). Total outflow from the Mountain Creek basin for the 1968 water year was 106,400 acre-feet. Storage in Mountain Creek Lake increased 130 acre-feet and rainfall during the water year was 36 inches, which is about 2 inches above the long-term mean for the area. Average discharge values and discharge extremes for 8 years of record (1960-68) are given for each of the 4 gaging sites. (Woodard-USGS)
W71-00045

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA, COMPILATION OF BASIC DATA, 1967,
Geological Survey, Houston, Tex.
S. L. Johnson.
Copies of report may be obtained from US Geological Survey, Water Resources Div, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 251 p, 15 fig, 22 tab.

Descriptors: *Rainfall, *Runoff, *Texas, Streamflow, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Urban Hydrology, *Houston (Texas), *San Jacinto River Basin, *Clear Creek Basin.

Compiled in this report are surface-water records for stream-gaging stations and crest-stage partial-record stations, and rainfall records at partial-record stations and miscellaneous sites within the Houston, Texas metropolitan area (San Jacinto River and Clear Creek basins) for the period October 1966 to September 1967. The objectives are to provide basic runoff data for small urban drainage areas which differ in topography, soil, vegetation, tributaries, basin shape, and degree of urbanization; to provide related rainfall data with consideration of variation in intensity and location; and to provide data showing the effects of progressive urbanization on flood peaks and volume. Maps, basic-data tables, and hydrograph and mass curves are included. (Woodard-USGS)
W71-00046

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 06B.
W71-00051

WATER-RESOURCES APPRAISAL OF THE LOWER VIRGIN RIVER VALLEY AREA, NEVADA, ARIZONA, AND UTAH,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W71-00058

RAINFALL-RUNOFF RELATIONS FOR SOUTHWESTERN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02A.
W71-00059

PEAK FLOW AND CRITICAL DURATION FOR SMALL WATERSHEDS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
C. L. Larson, and R. E. Machmeier.
American Society of Agricultural Engineers Transactions, Vol 11, No 2, p 208-213, 1968. 6 p, 7 fig, 3 tab, 17 ref.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, *Small watersheds, *Peak discharge, Routing, Rational formula, Parametric hydrology, Time lag, Model studies, Unit hydrographs, Computer programs, Duration curves, Runoff forecasting.
Identifiers: Critical duration.

A peak flow equation analytically based and applicable to the channel phase of runoff is presented. The equation is useful in estimating peak discharge for ungaged watersheds up to 100 sq mi or more in area. A new watershed time parameter, time to virtual equilibrium (Tve), is proposed. Both theory and results with a mathematical watershed model indicate that Tve is not constant, but varies as supply rate to a power from - 0.20 to - 0.30. For geometrically similar watersheds, it varies approximately as watershed area to the 0.30 power. A 50-year, duration-supply rate relationship is estimated for the model watershed. Peak discharges are then calculated by the peak-fow formula. Peak discharges are caused by a supply duration much less than time to equilibrium. For the model watershed, peak discharges for a given duration were not proportional to supply rate, as assumed in unit hydrograph analysis. Time parameters, including Tve, time to peak and lag time were not constant but varied with supply rate. Surface runoff is basically nonlinear. (Knapp-USGS)
W71-00061

HYDROLOGIC BASIN, DEATH VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00070

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
For primary bibliographic entry see Field 04A.
W71-00080

USE OF CHANNEL SLOPE AND DISCHARGE TO DETERMINE REAERATION COEFFICIENTS FOR THE ELKHORN RIVER IN NEBRASKA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 05B.
W71-00176

WATER-SURFACE ELEVATIONS AND CHANNEL CHARACTERISTICS FOR SELECTED REACHES OF THE ROGUE RIVER AND ELK CREEK, JACKSON AND JOSEPHINE COUNTIES, OREGON,
Geological Survey, Portland, Oreg.
D. D. Harris.
US Geological Survey Open-file report, 1970. 61 p, 43 fig, 6 tab, 4 ref.

Descriptors: *Floods, *Stage-discharge relations, *Surveys, *Oregon, Water levels, Planning, Zoning, Profiles, Flood plain zoning, Regulation, Gaging stations, Frequency analysis, Channel morphology, Data collections, Hydrologic data.
Identifiers: Rogue River (Oreg).

Water-surface profiles and channel characteristics, geometry and slope, are given for a reach of the Rogue River from the Jackson-Josephine County line, Oregon upstream to Lost Creek damsite and for a reach of Elk Creek from the mouth upstream to Elk Creek damsite. Profiles were defined for the flood of December 1964; the 20-year flood; the 10-year flood; the flood of December 1964 after adjusting for storage in the proposed upstream reservoirs; a low flow considered to be the minimum operational flow from the proposed reservoirs; and the thalweg (the lowest part of the channel bottom). The profile of the adjusted December 1964 flood was determined for the reach of the Rogue River downstream from Dodge Bridge where adjusted discharge data were available. The step-backwater method was used to define the high-water profiles; photogrammetric maps and water-depth soundings made during the periods of low flow ere used to define the low-water and thalweg profiles. (Knapp-USGS)
W71-00190

MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH 1967,
Geological Survey, Albany, N.Y.
Bernard Dunn.
New York Water Resources Commission Bulletin 67, 1970. 57 p, 1 tab.

Descriptors: *Stage-discharge relations, Discharge (Water), *Peak discharge, *New York, Data collections, Runoff, Streamflow, Hydrologic data, Stream gages.
Identifiers: Streamflow data.

Maximum stages and discharges in New York streams are compiled from the files of the U.S. Geological Survey. The data are tabulated under the heading of the major river or lake basin in which the stream is located. The period of record begins with the first calendar year and ends with the last calendar year for which a peak discharge is known. In most cases there are also peaks for each of the intervening years. (Knapp-USGS)
W71-00191

A PROPOSED STREAMFLOW DATA PROGRAM FOR MICHIGAN,
Geological Survey, Lansing, Mich.
Paul C. Bent.
Geological Survey Open-file report, 1970. 69 p, 5 fig, 8 tab, 8 ref, 1 append.

Descriptors: *Streamflow, *Data collections, *Synoptic analysis, *Project planning, Programs, Regression analysis, Runoff, Precipitation (Atmospheric).
Identifiers: Proposed streamflow-data program, Streamflow characteristics, Drainage basin characteristics, Natural-flow streams, Regulated-flow streams.

An evaluation of the streamflow data available in Michigan was made to provide guidelines for planning future water resource programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. It was found that most goals could not be met by regionalization of the data for gaged basins by regression analysis. This fact indicates that few changes can be made in the present program on the basis of computing data by regression formulas. However, regression formulas that include factors not evaluated as a part of this study, may provide a basis for regional streamflow analysis. The evaluation indicated that some changes in the streamgaging network can be made on the basis of length of records already collected. A streamflow data program based on the guidelines developed in this study is proposed for the future. (Woodard-USGS)
W71-00199

COMPILATION OF HYDROLOGIC DATA, COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Open-file report, 1970. 80 p, 3 fig, 3 tab.

Descriptors: *Rainfall, *Runoff, *Storage, *Texas, Streamflow, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Brazos River Basin (Texas), Weighted-precipitation record, Inflow and outflow computations.

This report contains rainfall, runoff, and storage data collected during the 1968 water year (October 1967 to September 1968) for the 79.6 square-mile area above stream-gaging station Cow Bayou at Mooreville, Brazos River Basin, Texas. Monthly and yearly rainfall, runoff, and storage data from 1957 to 1968 are included. The location of flood-water-retarding structures and hydrologic instruments in the area are shown. Current objectives of the study are to determine the net effect of flood-retarding structures on the regimen of streamflow at downstream points; to develop computation techniques that will provide more accurate estimates of runoff resulting from a given amount of rainfall on small watersheds; to develop relationships between maximum rates of runoff and rainfall in small watersheds that will enable more accurate design of small storm-drainage structures; and to determine the minimum instrumentation necessary to make reliable estimates of total storm inflow to the structures. (Woodard-USGS)
W71-00216

INFLUENCE OF LAND USE ON RUNOFF FROM AGRICULTURAL WATERSHEDS,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 04C.
W71-00218

WATER RESOURCES OF THE GUAYANILLA-YAUCO AREA, PUERTO RICO,
Geological Survey, San Juan, Puerto Rico.
James W. Crooks, I. G. Grossman, and Dean B. Bogart.
Commonwealth of Puerto Rico Water-Resources Bulletin 5, 1968. 55 p, 27 fig, 12 tab, 10 ref.

Descriptors: *Water resources development, *Puerto Rico, Surface waters, Groundwater, Water supply, Data collections, Hydrologic data, Hydrogeology, Conjunctive use, Water wells, Aquifers, Saline water intrusion.
Identifiers: Guayanilla-Yauco area (Puerto Rico).

More water is available for use than was being used in 1961 in the Guayanilla-Yauco area, which comprises the lower part of the basins of Rio Yauco, Rio Guayannilla, and Rio Macana, an area of about 33 sq mi in northwestern Puerto Rico. Water use in 1961 was about 37,000 ac-ft (acre-feet), a little more than half of which was groundwater. Of the quantity used, about 85% was for irrigation. About 43,000 ac-ft of streamflow enters the Guayanilla-Yauco area annually, on the average, much of which is lost to the sea during floods. In addition, rainfall on the area averages about 67,000 ac-ft, making a total input to the area of about 110,000 ac-ft. In the drier-than-average year of 1962, the total input was about 79,000 ac-ft. The easiest and least costly way to obtain more water on a year-round basis is by means of wells. Up to 30 mgd water can be obtained if a comprehensive system of facilities and management is developed. This system would include surface reservoirs if adequate sites can be located for storage of flood waters now largely wasted to the sea. The water is hard, but it is suitable for municipal use and for many industrial purposes with simple treatment. Most of the water is suitable for irrigation without treatment. The water in a narrow zone along the coast is brackish, but no data to date indicate active salt-water encroachment. (Knapp-USGS)
W71-00228

FLOODS OF MARCH-MAY 1965 IN THE UPPER MISSISSIPPI RIVER BASIN,
Geological Survey, Washington, D.C.
D. B. Anderson, and I. L. Burmeister.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC - Price $2.25. Geological Survey Water-Supply Paper 1850-A, 1970. 448 p, 50 fig, 9 tab, 13 ref.

Descriptors: *Floods, *Flood damage, *Streamflow, Peak discharge, Meteorological data, Climatic data, Gaging stations, Flood plains, Flood forecasting.
Identifiers: Recurrence intervals, Drainage and storage effects.

The floods of March-May 1965 in the upper Mississippi River basin occurred as two different events, one during the latter part of February and early March and the other starting early in April and extending into May. Factors contributing to the floods were rapid melting of the winter accumulation of snow, heavy rains on the snow pack, and deeply frozen ground throughout much of the basin, which made the soil almost impervious and thereby greatly increased the amount of runoff. Peak stages and discharges during the floods exceeded previous known maxima at many points. Included in this report are peak stages and discharges for these floods at 333 sites; the previous maxima at these sites where such data are available; the recurrence interval for many sites; flood damages; effect of drainage and storage on flood peaks; and the operations of the U. S. Geological Survey and other Federal agencies during the flood emergency. (Woodard-USGS)
W71-00304

HYDRAULICS OF BRIDGE WATERWAYS.
Bureau of Public Roads, Washington, D.C. Bridge Div.
For primary bibliographic entry see Field 08B.
W71-00350

WATER-SURFACE ELEVATIONS AND CHANNEL CHARACTERISTICS FOR A SELECTED REACH OF THE APPLEGATE RIVER, JACKSON COUNTY, OREGON,
Geological Survey, Portland, Oreg.
D. D. Harris, and C. W. Alexander.
Geological Survey Open-file report, 1970. 42 p, 30 fig, 4 tab, 5 ref.

Descriptors: *Profiles, *Floods, *Stage-discharge relations, *Oregon, Mapping, Flood forecasting, Streamflow forecasting, Hydrologic data, Data collections, Water levels, Channel morphology, Planning, Flood plains, Flood protection, Flood control, Reservoirs.
Identifiers: Applegate River (Oreg).

Flood and low-water elevations for a selected reach of the Applegate River, Oregon from the Jackson-Josephine County line to the Applegate damsite are presented in tables and graphical profiles. Elevations for a discharge on the Applegate River equivalent to that of the flood in December 1964, but reduced by storage in the proposed Applegate Reservoir, would fall between 10- and 20-year flood elevations downstream from Beaver Creek (river mile 40.6). Upstream from Beaver Creek, the adjusted December 1964 flood would be lower than a 10-year flood. The computed water-surface profiles are generally in good agreement with the documental flood elevations. (Knapp-USGS)
W71-00353

DEVELOPMENT OF A RESISTANCE-WIRE WAVE GAUGE FOR SHALLOW-WATER WAVE AND WATER-LEVEL INVESTIGATIONS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 07B.
W71-00357

A NEW 'BASELESS' PROPORTIONAL WEIR,
Indian Inst. of Science, Bangalore (India). Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 07B.
W71-00359

JOINT PROBABILITY METHOD OF TIDE FREQUENCY ANALYSIS APPLIED TO ATLANTIC CITY AND LONG BEACH ISLAND, N. J.,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 04A.
W71-00378

METEOROLOGICAL ASPECTS OF HURRICANE CAMILLE--AUGUST 14-22, 1969,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02B.
W71-00382

HYDRAULIC JUMP WITHIN A GRADUALLY EXPANDING CHANNEL,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 08B.
W71-00383

FLOOD HYDROLOGY OF SMALL WATERSHEDS: EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
I-pai Wu.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 655-660, 663, September-October 1969. 7 p, 11 fig, 1 tab, 19 ref. OWRR Project B-006-HI.

Descriptors: *Floods, *Hydrology, *Small watersheds, *Rainfall-runoff relationships, *Hawaii, Peak discharge, Time, Rainfall, Runoff, Streamflow, Gaging stations, Hydrographs, Equations, Parametric hydrology, Frequency analysis, Runoff forecasting, Depth-area-duration analysis, Rainfall intensity.

This paper is based on the evaluation of more than 250 hydrographs from about 30 small watersheds on the island of Oahu. The existing drainage-design criteria for the Hawaiian Islands are arbitrarily set in two groups: the rational formula is used for areas less than 100 acres where the coefficient C is revised from mainland standards. Frequency analysis or envelope curves based on maximum experience are used for watersheds larger than 100 acres. A frequency analysis for annual peak discharge was made for 23 watersheds (island of Oahu) and peak discharge of 100-year, 24-hr precipitation for the determination of peak discharge for ungaged areas. The relationship between peak discharge and runoff appears to be linear for a given watershed regardless of intensity, duration and size of the storm. The time to peak which varies slightly from different hydrographs will not change the general shape of the hydrograph or the linearity of the peak discharge and runoff relation. However, this linear relation cannot be extended beyond 6 inches of runoff. Graphs, equations, tables of data, and a map locating gaging stations are included. (Woodward-USGS)
W71-00403

ENERGY DISSIPATION IN OPEN CHANNELS BY LARGE SEMI-CIRCULAR DISK ROUGHNESS ELEMENTS,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 08B.
W71-00406

DELAWARE RIVER MODEL STUDY, REPORT NO 1. HYDRAULIC AND SALINITY VERIFICATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-00443

STREAMFLOW CHARACTERISTICS OF THE NORTHEASTERN UNITED STATES,
Pennsylvania Agricultural Experiment Station, University Park.
William E. Sopper, and Howard W. Lull.
Available from NTIS as PB-192 878, $3.00 in paper copy, $0.95 in microfiche. Bulletin 766, June 1970. 141 p.
Identifiers: *Forestry, Management planning, *Rivers, United States, *Hydrology, Reviews, Periodic variations, Meteorological parameters, Fluid flow, Volume, *Streamflow characteristics, Watersheds, Northeastern United States, Seasonal runoff.

Forest watershed management research was intiated in Northeastern United States in 1948 and is continuing on 29 small, forested experimental watersheds located in New Hampshire, New Jersey, Pennsylvania, Maryland, and West Virginia. One of the common objectives of these research programs is to determine the effect of the forest cover and forest management practices on streamflow, specifically, the quantity of water yield and its time distribution, and water quality. Four studies were conducted. The first was to determine average annual and seasonal water yields, flow duration, and high daily flows for 137 watersheds and to relate these, insofar as possible, to the seven major physiographic regions in the Northeast. In the second study, the relationships of average anual and seasonal discharges, flow-duration discharges, and high daily flow discharges to selected climatic, geographic, topographic, and land-use variables were investigated. This analysis was extended in the third study to better define the relationships between the water yield parameters and the climatic and physical watershed variables within each of the physiographic regions. The fourth study was concerned primarily with the determination of the representativeness of the small experimental watersheds in relation to the physiographic region in which they are located.
W71-00464

HYDRAULIC GEOMETRY OF 12 SELECTED STREAM SYSTEMS OF THE UNITED STATES,
Illinois State Water Survey, Urbana.
John B. Stall.
Available from NTIS as PB-195 165, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 32, July 1970. 73 p, 25 tab, 28 fig, 32 ref, append. OWRR Project B-023-ILL (1).

Descriptors: *Channels, *Hydraulics, *Streams, *Flow, Open channel flow, Streamflow, Runoff.
Identifiers: *Re-oxygenation, Hydraulic geometry.

A completed project shows there to be, for the 18 river basins in Illinois, a consistent pattern in which the width, depth, and velocity of flow in a stream change along the course of the stream, with a constant frequency of discharge. These channel characteristics are termed hydraulic geometry and constitute and interdependent system which can be described by a series of graphs having simple form or by equations. The data from about 250 stream gaging stations will be assembled and used to develop the parameters to define the hydraulic geometry of stream systems for ten river basins selected to represent various physiographic and hydrologic regions of the humid part of the United States. These parameters are to be generalized for various physiographic divisions and used to help explain variability of other observed hydrologic phenomena such as low flow frequency, and flow-duration. These parameters will also be used to predict the average depth and velocity of flow at problem locations on the stream where no measurements are available. This will allow computation of the re-oxygenation capacity of the stream at a problem location, and the time-of-travel of contaminants through the stream system.
W71-00472

SIMULATION OF CONTINUOUS DISCHARGE AND STAGE HYDROGRAPHS IN THE NORTH BRANCH OF THE CHICAGO RIVER.
Hydrocomp International, Inc., Palo Alto, Calif.

Report to Northeastern Illinois Planning Commission, Chicago, Illinois, 1970. 56 p, 14 fig, 13 tab.

Descriptors: *Simulation analysis, *Streamflow forecasting, *Streamflow, *Hydrographs, *Mathematical models, *Urbanization, *River forecasting, *Flood forecasting, *Flood control, *Flood plains, *Model studies, *Watershed management, *Stage-discharge relations, *Illinois, Flow, Surface runoff, Computer models, Channel improvements, Planning, Watersheds.
Identifiers: *Chicago River.

The report summarizes streamflow simulation studies of the North Branch of the Chicago River using mathematic modeling techniques. The Northeastern Illinois Planning Commission had the studies made to aid: (1) the development of regional maps delimiting flood plains for 25, 50 and 100 year frequencies, based upon present physiographic conditions and continued urbanization; (2) evaluation of the hydrologic impact of flood control works, channel constrictions, and changes in urban development patterns. These objectives are essential for intelligent land use planning, and are required in the National Flood Insurance Program. The stream studied flows into and through the Chicago metropolitan area and is typical of watersheds in Northeastern Illinois. It has a flat stream channel gradient and broad flood plains at high discharge. Simulation studies showed that steps must be taken either to preserve the stream's perogative to flow over its flood plain, or substantially alter the stream channels as they now exist. If flood plain storage is taken for a subdivision at one point, it could be returned to the stream at another point by land purchase and excavations. Alternately, if channel storage is not preserved, large floodways, detention basins or underground caverns will be needed. Results of simulation studies of flood discharge and stage are presented by tables and graphs. (Poertner)
W71-00483

GOODWIN V TEXAS CO (LIABILITY FOR DAMAGES FOR SEEPAGE OF COLLECTED WATER AND OBSTRUCTION OF WATER-COURSE).
For primary bibliographic entry see Field 06E.
W71-00512

2F. Groundwater

GROUNDWATER BASIC DATA, ORANGE AND ULSTER COUNTIES, NEW YORK,
Geological Survey, Albany, N.Y.
Michael H. Frimpter.
New York Water Resources Commission Bulletin 65, 1970. 93 p, 1 fig, 2 plate, 3 tab.

Descriptors: *Water wells, *New York, *Data collections, *Hydrologic data, Hydrogeology, Aquifers, Groundwater, Water resources.
Identifiers: Ulster County (NY), Orange County (NY).

Basic groundwater data useful in planning and studying the development of groundwater in Orange and Ulster Counties, N.Y., are tabulated. The records of 1,660 wells and springs are reported. Graphic lithologic logs of 497 wells and test borings and the results of 128 chemical analyses of well water are presented. (Knapp-USGS)
W71-00003

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 1970,
Geological Survey, Salt Lake City, Utah.
C. T. Sumsion, L. J. Bjorklund, E. L. Bolke, R. W. Mower, and L. R. Herbert.
Utah Division Water Resources Cooperative Investigations Report No 8, 1970. 71 p, 36 fig, 2 tab, 7 ref.

Descriptors: *Hydrologic data, *Groundwater, *Water levels, *Utah, Hydrogeology, Water resources, Water resources development, Irrigation water, Water wells, Water level fluctuations, Recharge, Water yield, Water quality, Data collections.
Identifiers: Groundwater levels.

This report contains information on well construction, groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow in Utah. It also contains supplementary data that are related to groundwater use in some areas. Less than 2% of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, limestone, and sandstone. More than 98% of the wells in Utah draw water from unconsolidated rocks. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains. The estimated total withdrawal of water from wells in Utah during 1969 was about 670,000 acre-feet, about 40,000 acre-feet more than that reported for 1968. Precipitation during most of the growing season was less than normal in parts of the State where the largest withdrawals are for irrigation, so irrigation withdrawals increased in these areas. Although all types of groundwater withdrawals except public supply increased, water levels generally rose throughout the State from March 1969 to March 1970 as a result of above-normal precipitation. Groundwater development and changes in groundwater conditions in the major areas of groundwater development are summarized. (Knapp-USGS)
W71-00004

THEORY OF FLOW TO DRAINS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Jan Van Schilfgaarde.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 43-106, 1970. 64 p, 18 fig, 82 ref.

Descriptors: *Reviews, *Drainage systems, *Soil water movement, *Groundwater movement, Saturated flow, Unsaturated flow, Steady flow, Unsteady flow, Darcys law, Dupuit-Forchheimer theory, Water levels, Salinity, Water level fluctuations, Recharge, Discharge (Water), Hydraulic conductivity.
Identifiers: Flow to drains.

The basic principles on which the theory of fluid flow is based, developments from these principles as they apply to drainage, and their application to practical design problems are reviewed. In humid areas, the primary functions of drainage systems are: to provide an environment favorable for plant roots, and a soil-physical condition conducive to economic farming operations. In irrigated regions, the primary function is to establish or maintain a favorable salt balance in the soil. The engineer needs to know the physical properties of the soil before he can design the drainage system. Of primary concern are reliable estimates of hydraulic conductivity, depth of the water-conducting layer and pore space distribution. Flow theory permits the determination of water table heights. In principle, this approach enables the derivation of design criteria and economic evaluation. It also provides the framework for study of the response of crop plants to drainage. The review includes the Navier-Stokes and Darcy equations of motion, equations for saturated flow, and equations for unsaturated flow. Both steady and unsteady flows are discussed. Methods and theory for soil-property measurements are reviewed. Applications of theory and techniques to drainage design are outlined. (Knapp-USGS)
W71-00007

TWO-LIQUID FLOWS IN POROUS MEDIA,
Technion - Israel Inst. of Tech., Haifa.
Jacob Bear.
In: Advances in Hydroscience, Vol 6, New York, N Y, Academic Press, p 141-252, 1970. 112 p, 53 fig, 72 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Reviews, *Interfaces, Saline water-freshwater interfaces, Saline water intrusion, Stratified flow, Oil-water interfaces, Air-water interfaces, Porous media, Flow, Diffusion, Dispersion, Mixing, Aquifers.
Identifiers: Two-liquid flow.

Some basic concepts, techniques and methods of investigation of problems involving the flow of two fluids through a porous medium are reviewed. Such problems are often encountered in groundwater hydrology and (oil) reservoir engineering. Miscible displacement or hydrodynamic dispersion is a type of two-fluid flow in which the two fluids are completely soluble in each other. A distinct fluid-fluid interface does not exist. Immiscible displacement is the simultaneous flows of two or more immiscible fluids. A distinct fluid-fluid interface separates the two fluids within each pore. In many cases of interest, the transition zone in the case of miscible fluids is relatively narrow so that for all practical purposes a fictitious abrupt interface separates the two fluids. On each side of this imaginary interface is a single phase only. This assumption appreciably simplifies the treatment of the two-fluid problem. Across the mixing zone between sea water and fresh water in coastal aquifers the density of the water varies gradually from that of fresh water to that of sea water. Artificial recharge also introduces one quality of water into an aquifer containing water of another quality. Unsaturated flow is the flow of water and water vapor through a soil in which the void space is partly filled with air. Essentially, this is a case of simultaneous flow of two immiscible fluids (water and air) except that often the assumption is made that the air is practically immobile. (Knapp-USGS)
W71-00009

UNSTEADY SEEPAGE TOWARD NARROW DITCH,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-00021

EFFECTS OF GROUNDWATER SEEPAGE ON FLUVIAL PROCESSES,
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
Samuel S. Harrison, and Lee Clayton.
Geological Society of America Bulletin, Vol 81, No 4, p 1217-1225, April 1970. 9 p, 6 fig, 9 ref. NSF Grant 4424.

Descriptors: *Sediment transport, *Surface-groundwater relationships, *Seepage, *Stream erosion, Permeability, Channel morphology, Roughness (Hydraulic), Mud, Sands, Sediments, Discharge (Water).
Identifiers: Stream competence.

Field observations of a small stream have indicated that seepage of water into or out of a stream may greatly alter stream competence. Theoretically, water seeping through the stream bed exerts a drag on quartz grains that changes stream competence by the factor 1.65/ (1.65-i) where i is the seepage gradient. Experiments in laboratory flumes, however, indicate that seepage through a stream bed, despite its effect on effective grain density, causes no change in competence in gaining streams nor in losing streams that lack a mud seal. Possibly the expected change in competence is partially counteracted by the accompanying changes in form drag and surface drag on the grains. Flume experiments also show that upward seepage reduces the steepness of bed forms and decreases bed roughness, whereas downward seepage steepens

the bed forms and increases bed roughness, but these changes appear to be insufficient to cause any measurable change in the slope of the water surface. Downward seepage in the presence of sufficient suspended sediment, however, can lead to the formation of a mud seal on the surface of a stream bed; this results in a great increase of the effective density of the bed sediment and may result in the total elimination of sediment entrainment from the bed. (Knapp-USGS)
W71-00028

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02A.
W71-00029

REGIONAL GROUNDWATER FLOW BETWEEN LAKE SIMCOE AND LAKE ONTARIO,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
C. J. Haefeli.
Canada Department Energy, Mines and Resources, Inland Waters Branch Technical Bulletin No 23, 1970. 42 p, 25 fig, 2 plate, 51 ref.

Descriptors: *Hydrogeology, *Groundwater movement, *Surface-groundwater relationships, *Lake Ontario, Water levels, Groundwater basins, Surveys, Aquifers, Glacial drift, Water chemistry, Water wells, Data collections.
Identifiers: Regional groundwater flow, Lake Simcoe (Ontario), Canada.

Lake Simcoe is 35 to 40 miles north of and about 470 feet higher than Lake Ontario. However, the average elevation of the Lake Simcoe Basin is only about 250 feet higher. The surface water divide within the study area of 600 square miles lies mainly between elevations 900 and 1100 feet. The relatively high elevation of the Lake Simcoe Basin, the south dipping surface and bedding of the bedrock, and especially the north-south directed, deep bedrock channels point to the possible existence of a southbound groundwater flow system. The thickness of the quaternary deposits varies considerably between Lake Ontario and Lake Simcoe. From less than 50 feet at the south-eastern shore of Lake Simcoe, the drift increases to over 400 feet in the area between Newmarket and Richmond Hill. From there, it begins to decrease southwards, becoming 25 to 75 feet thick along Lake Ontario's shoreline south and west of Toronto. Regional, extensive, well defined aquifers do not exist. The general pattern of the quaternary deposits is a body of very low permeability with enclosed high permeable lenses of various sizes. The highest transmissibility values for the most productive aquifer lenses range approximately from 40,000 to 80,000 Igpd/ft which suggests that good aquifers do exist although they may be difficult to define. Most of the pumping tests show impermeable boundary conditions. The configuration of the water table corresponds generally with the topography. Piezometric, hydrogeochemical and mathematical analyses demonstrate the non-existence of major seepage from Lake Simcoe into the Lake Ontario basin. The groundwater divide coincides approximately with the basin boundary in the quaternary deposits as well as in the different underlying bedrock formations. (Knapp-USGS)
W71-00031

ELECTRIC ANALOG MODEL EVALUATION OF A WATER-SALVAGE PLAN, SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00034

RESULTS OF TEST DRILLING AT THE CENTRAL GREAT PLAINS FIELD STATION NEAR AKRON, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
Warren E. Hofstra.
Geological Survey Open-file report, June 1970. 26 p, 4 fig, 2 tab, 3 ref.

Descriptors: *Hydrologic data, *Aquifers, *Colorado, *Sampling, *Water wells, Water levels, Boreholes, Stratigraphy, Hydrogeology, Water resources, Water resources development, Maps, Cross-sections.
Identifiers: Central Great Plains Field Station (Colo).

The U. S. Geological Survey collected geologic, hydrologic and geophysical information from 16 test holes drilled at the Central Great Plains Field Station, Colorado during the period June 5 to July 3, 1969. The Field Station is located about 4 miles east of Akron, Washington County, Colo. The work was done at the request of the U. S. Department of Agriculture to obtain information on lithologic variations in the Ogallala Formation of Pliocene age. Observation wells were installed in the test holes to monitor the movement of water. This report presents the basic data collected during the test-drilling program, and a water-table contour map, a bedrock contour map, and a generalized section. Results of the test drilling, a lithologic description, and moisture content of cores are given in the tables. The geophysical logs are on file in the Colorado District Office, Water Resources Division, U. S. Geological Survey, Denver, Colo. and at the Central Great Plains Field Station, Akron, Colo. (Knapp-USGS)
W71-00037

GROUNDWATER RESOURCES OF THE LOWER HILLSBORO CANAL AREA, SOUTHEASTERN FLORIDA,
Geological Survey, Tallahassee, Fla.
H. J. McCoy, and Jack Hardee.
Florida Bureau of Geology Report of Investigation No 55, 1970. 44 p, 21 fig, 3 tab, 14 ref.

Descriptors: *Water resources, *Groundwater, *Hydrogeology, *Florida, Aquifers, Saline water intrusion, Water yield, Water quality, Transmissivity, Monitoring, Data collections, Hydrologic data, Water resources development, Urbanization.
Identifiers: Hillsboro Canal Area (Fla).

The lower Hillsboro Canal area occupies about 60 square miles of Palm Beach and Broward counties in southeastern Florida. All potable groundwater is obtained from the Biscayne aquifer. The aquifer extends from the land surface to a depth of about 400 feet and is composed of sand, sandy limestone, shells, and indurated calcareous sand. Municipal well fields of Deerfield Beach and Boca Raton and most of the domestic, irrigation, and industrial wells obtain adequate water supplies from permeable limestone 90 to 130 feet below land surface. Rainfall in the area and induced infiltration from controlled canals provide the recharge to the aquifer. Sea-water intrusion, although a constant threat, has not advanced inland enough to contaminate either municipal well field. Data collection stations are maintained to monitor changes of the salt-water front in the aquifer. Large quantitites of water can be withdrawn from the interior part of the area without the threat of salt-water intrusion. (Knapp-USGS)
W71-00039

HYDROGEOLOGIC DATA FOR THE LOWER ARKANSAS RIVER VALLEY, COLORADO,
Geological Survey, Denver, Colo.
Thomas J. Major, R. Theodore Hurr, and John E. Moore.
Colorado Water Conservation Board Groundwater Series Basic Data Report No 21, 1970. 125 p, 5 fig, 4 plate, 7 tab, 15 ref, append.

Descriptors: *Hydrologic data, *Groundwater, *Colorado, *Water levels, Hydrogeology, Water level fluctuations, Irrigation, Irrigation water, Water utilization, Data collections, Water resources development, Hydrographs, Water yield.
Identifiers: Arkansas River Valley (Colo).

Groundwater use as a supplemental irrigation supply in the Arkansas River valley increased substantially between 1950 and 1965. During this 15-year period about 1,000 wells were drilled. Withdrawal of groundwater by wells increased from 31,000 to 185,000 acre-feet annually in this period. The annual average withdrawal was 65,400 acre-feet for the first 5 years and 144,000 acre-feet for the last 5 years. This report presents the basic data collected during the inventory of the water resources of the reach of the valley from Pueblo to the Kansas State line. It includes maps showing the location of large-capacity irrigation, public supply, and industrial wells, records of well construction and yield, chemical analyses of groundwater, water-level measurements, and well logs. Records of 1,348 irrigation wells and 119 public supply and industrial wells are included. (Knapp-USGS)
W71-00047

GEOLOGIC MAP OF THE LOWER CACHE LA POUDRE RIVER BASIN, NORTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
Lloyd A. Hershey, and Paul A. Schneider, Jr.
Geological Survey Open-file report, May 1970. 1 map.

Descriptors: *Maps, *Geologic mapping, *Colorado, Hydrogeology, Hydrologic data, Stratigraphy, Geological surveys, Aquifers, Water yield.
Identifiers: Cache La Poudre River basin (Colo).

A geologic map of the Lower Cache La Poudre River basin of north-central Colorado includes descriptions of water yield to wells with the lithologic descriptions of the formations mapped. The rocks of the area range in age from Precambrian to Holocene and include gneisses, conglomerates, shales, sandstones, limestones, and unconsolidated alluvium and colluvium, all of which (except the shales) yield water. (Knapp-USGS)
W71-00049

GROUNDWATER RESOURCES -- APPENDIX H TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA,
Geological Survey, Washington, D.C.
Granville A. Wyrick, and Orville, B. Lloyd, Jr.
Report on Development of Water Resources in Appalachia published in 25 volumes. Geological Survey Cooperative Report, Vol 23 of 25 Vol, Append H, 1968. 122 p, 23 fig, 2 tab, 83 ref.

Descriptors: *Water resources development, *Groundwater, *Appalachian Mountain region, Water supply, Water costs, Optimum development plans, Economic justification, Project planning, River basin development, Water yield, Water quality, Hydrogeology, Geology.
Identifiers: Appalachian redevelopment.

This Appendix, 'Ground Water', provides figures on the amount of available groundwater and the costs of developing groundwater supplies in Appalachia. The relative availability and occurrence of groundwater and the relative cost and optimum development of groundwater supplies are described for the Region as a whole. Groundwater information is presented for specific sites which have been selected for study by the Corps of Engineers because of obvious needs for local water supplies to stimulate local economic growth. (See also W71-00051) (Knapp-USGS)
W71-00052

A STUDY IN THE GROUNDWATER HYDROLOGY OF THE MEERUT DISTRICT, UTTAR PRADESH, INDIA,
Banaras Hindu Univ., Varanasi (India). Dept. of Geography.
R. N. Mathur.
Varanasi, India, Banaras Hindu University, 1969. 109 p, 34 fig, 11 tab, 268 ref.

Descriptors: *Water resources development, *Groundwater, *Hydrologic budget, Groundwater basins, Water yield, Aquifers, Alluvium, Transmissivity, Water levels, Climates, Topography, Surveys, Water utilization, Irrigation water.
Identifiers: *India, Uttar Pradesh (India), Ganga Plain (India).

A study of the groundwater hydrology of the Meerut district in the Ganga Plain in Uttar Pradesh, India includes descriptions of climate, physiography, and geology, as well as hydrogeology. This is the first such hydrogeologic study ever made in India. An important part of the analysis is a calculation of the hydrologic budget of the area. The Ganga Plain area is being exploited for groundwater on a very large scale; the irrigation project is probably the largest in the world. The plain is a continuous and conformable series of alluvial deposits, composed of unconsolidated sand, clay, gravel and their mixtures. The older alluvium is Middle Pleistocene whereas the younger gradually passes into the Recent. Coarse sand beds, either alone or with consolidated sand, gravel or pebble beds, generally occur at relatively greater depths; whereas clay beds predominate at shallower depths. An aggregate thickness of about 100 feet of good water-bearing strata are generally present in an average depth of 300 feet. Withdrawals of more than 350 acre-feet per square mile may result in a permanent lowering of the water table and in increasing pumping costs. The present spacing of about 2 square miles per tube-well can be somewhat reduced because the area of influence per well amounts to 1 square mile. (Knapp-USGS)
W71-00057

WATER-RESOURCES APPRAISAL OF THE LOWER VIRGIN RIVER VALLEY AREA, NEVADA, ARIZONA, AND UTAH,
Geological Survey, Carson City, Nev.
Patrick A. Glancy, and A. S. Van Denburgh.
Nevada Division of Water Resources, Water Resources-Reconnaissance Series Report 51, 1969. 87 p, 4 fig, 2 plate, 2 photo, 22 tab, 52 ref.

Descriptors: *Water resources, *Surveys, *Nevada, Surface waters, Groundwater, Streamflow, Water yield, Aquifers, Water supply, Water resources development, Data collections, Hydrologic data, Hydrogeology, Water quality, Evapotranspiration.
Identifiers: Virgin River Valley (Nev).

A water-resources reconnaissance was made of the lower Virgin River Valley, Tule Desert, and Escalante Desert basin in Nevada. THE LOWER Virgin River Valley comprises the river flood plain and its tributary drainages from The Narrows, about 5 miles east of Littlefield, Arizona, downstream to the river's confluence with Lake Mead. The lower Virgin River is the dominant hydrologic feature of the area. Water contributed to the river's floodplain area includes direct precipitation, river inflow, and groundwater underflow, plus surface-and groundwater inflow from tributary drainages within the report area. Outflow includes streamflow and groundwater underflow to Lake Mead, consumptive use, and natural evapotranspiration. Most consumptive use is for irrigation of crops by diversion of surface flow. Only a small amount of groundwater is pumped for irrigation, but groundwater reservoirs furnish most of the municipal, domestic, and livestock supply. Water in the Virgin River usually contains 1,000-3,000 mg/l of dissolved solids--largely calcium, sodium, sulfate, and chloride. Groundwater along the river characteristically is very hard, and contains 500 to as much as 5,000 mg/l of dissolved solids, dominated by sulfate and sodium or calcium. (Knapp-USGS)
W71-00058

WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Denver, Colo.
Arnold J. Boettcher, Warren E. Hofstra, and Thomas J. Major.
Colorado Water Conservation Board Groundwater Series Basic-Data Release No 20, 1969. 189 p, 4 fig, 3 plate, 1 tab.

Descriptors: *Hydrologic data, *Colorado, *Water levels, *Water level fluctuations, *Water wells, Irrigation wells, Alluvium, Aquifers, Withdrawal, Data collections, Sampling, Water resources, Water yield, Hydrographs.
Identifiers: High Plains (Colorado), Ogallala formation.

The northern High Plains of Colorado is bounded by the State line on the east, the South Platte River on the north, the Arkansas River on the south, and extends west to Limon, Colo. Irrigation supplies are derived almost entirely from wells tapping the Ogallala Formation. The semiconsolidated Ogallala consists of sand, gravel, silt, and clay, and ranges in thickness from a few feet on the west to as much as 400 feet in places near the State line. Groundwater withdrawals in the area nearly quadrupled between 1960 and 1968 as the number of irrigation wells increased. In 1960 there were 480 wells and in 1968 there were 1,810 wells. Utilization of the resources at this rate has caused significant water-level declines in areas where wells are concentrated. This report presents water-level records collected by personnel of the U. S. Geological Survey and Colorado State University. A large part of this report was compiled by automatic storage and retrieval methods. Water-level measurements for each well were punched on cards and printed by a computer. In January 1964, the number of observation wells was increased from 52 to 400 to provide a better sampling of water-level changes. Measurements in the 400 observation wells also were made in 1966, and 1969, and will be made annually in the future. (Knapp-USGS)
W71-00060

HYDROLOGIC BASIN, DEATH VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
Charles B. Hunt, T. W. Robinson, Walter A. Bowles, and A. L. Washburn.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402. US Geological Survey Professional Paper 494-B, 1966. 138 p, 73 fig, 3 plate, 53 tab, 139 ref.

Descriptors: *Groundwater basins, *California, *Deserts, Arid lands, Saline water systems, Brines, Sedimentation, Chemical precipitation, Hydrology, Hydrogeology, Groundwater movement, Stratigraphy, Geology, Evaporation.
Identifiers: Death Valley (Calif).

The Death Valley hydrologic basin covers about 8,700 square miles, of which about 500 square miles is below sea level. The bottom of the basin--the saltpan in Death Valley, one of the world's great saltpans--covers more than 200 square miles and lies as much as 282 feet below sea level. Death Valley is the hottest and driest part of the United States. Temperatures greater than 120 deg F are common during the summer, and a maximum of 134 deg F has been recorded. Annual rainfall in the valley averages about 1.66 inches; the average precipitation in the entire hydrologic basin probably is about 4-5 inches. The evaporation rate in Death Valley is about 150 inches per year. In the central part of Death Valley, salt deposits form a crust covering most of 200 square miles, about 10 percent of the hydrologic basin. Most of the distinctive hydrologic features of the basin are directly the result of the structural geology. Groundwater is ponded in the structural basins, and it moves from one basin to another along faults that extend through topographic divides. Groundwater also enters the basin along faults from neighboring basins. The thickness of the salt crust on the saltpan ranges from a few inches to a few feet. Under the crust is silt and clay. At the center of the pan, the salts in the crust and the brines are mostly chlorides. These chlorides are surrounded by a narrow zone in which the salts are chiefly sulfates; these sulfates, in turn, are surrounded by a sandy zone containing carbonate salts and forming the edges of the pan. This zoning reflects the differences in solubility of the salts. (Knapp-USGS)
W71-00070

ON THE FAUNA OF ASELIDAE IN THE BED OF A TRIBUTARY OF THE SAONE (IN FRENCH),
Dijon Univ. (France). Faculty of Science.
Jean-Paul Henry, and Guy Magniez.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 19, Serie D, p 2366-2368, 1970. 1 fig, 8 ref.

Descriptors: *Ecological distribution, *Aquatic animals, *Sediment-water interfaces, Microenvironment, Sediments, River beds, Crustaceans, Diptera, Detritus, Water analysis, Analytical techniques.
Identifiers: *Saone River (France), Subsurface water environments, Interstitial waters, Alluvial deposits, Aselidae, Proasellus.

The method of the interstitial water analysis, developed by Bou and Rouch, permitted to discover an association of four forms of Aselidae in the bed of the Ouche, a tributary to the Saone River. The presence of the two epigeoic sub-species of these crustaceans in the hypogeoic environment (80 centimeters below the benthos) demonstrated the wide ecological amplitude of these amphothalms. The coexistence of Proasellus cavaticus walteri and P c puteans indicated specific heterogeneity of P cavaticus. The distribution of Aselidae suggested the course of geologic dynamics during the quartenary period. (Wilde-Wisconsin)
W71-00103

POPULATION OF CIRCULATING WATER IN THE ZONE OF INTERMITTENT PERCOLATION IN THE KARSTIAN MASSIF (IN FRENCH),
Centre Nationale de la Recherche Scientifique, Moulis (France). Laboratoire Souterrain.
Bernard Delay.
Comptes Rendus Academie des Sciences, Paris, Vol 268, No 5, Serie D, p 1917-1920, 1969. 2 tab, 10 ref.

Descriptors: *Subsurface water, *Capillary water, *Crustaceans, Aquatic population, Population, Percolating water.
Identifiers: *Terrestrial fauna, Karstian massif, Stalagmites, Grottoes, France.

Samples of percolating subterranean water were collected from stalagmites of three grottoes near Castillon-Milhos, France. The filtration procedure yielded 1708 hypogeoic aquatic crustaceans in different stages of development. The organisms included the members of Cyclopoides, Harpacticides, Syncarides, and Asellides. These were accompanied by representatives of terrestial fauna, entrapped by water: Acarinas, Nematodes, Oligochaetes, Rhobdocoeles, and Rotifers. This study affirms the existence of a regular passage of hypogeolic crustaceans across the zone of intermittent percolation of karstian formation. (Wilde-Wisconsin)
W71-00112

THE ARCHIVES FOR GROUNDWATER LEVELS T.N.O. IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
J. H. Beltman.
Annals of Arid Zone, Vol 8, No 2, p 257-266, September 1969. 4 fig, 2 ref.

Descriptors: *Observation wells, *Groundwater, *Regression analysis, *Networks, Data collections, Governments, Hydrologic data, On-site data collections, Water table, Equations, Statistical methods.
Identifiers: *Netherlands, *Groundwater levels, Archives.

Responding to the necessity for groundwater level studies, 3 networks of observation wells--both, for artesian and phreatic water--have been established throughout the Netherlands. The networks are dependent upon the selection of 'key wells' which are observation wells representative of their areas. In most areas, simple statistical relationships exist between groundwater levels in key wells and other wells in their area. Regression lines may be calculated for levels in differing wells, and the statistical theory and its practical applications are described. Problems in measuring abnormal water levels in certain areas due to groundwater withdrawal are discussed. At the present time there are 11,342 observation wells in the country. This type of network is also applicable to areas of the arid Southwest U. S. and elsewhere. (Casey-Arizona)
W71-00144

GEOBOTANICAL STUDIES IN GEO-HYDROLOGICAL SURVEYS IN THE ARID ZONE OF W. RAJASTHAN,
Central Arid Zone Research Int., Jodhpur (India).
P. C. Chatterji, and R. K. Gupta.
Annals of Arid Zone, Vol 8, No 2, p 246-250, September 1969.

Descriptors: *Phreatophytes, *Arid lands, *Xerophytes, *Hydrogeology, *Groundwater, Geomorphology, Water quality, Salinity, Mapping, Petrography, Grasses, Legumes, Plant populations, Exploration.
Identifiers: *India, *Rajasthan Desert, *Geobotany, Groundwater exploration, Groundwater depth, Plant communities, Total soluble salts.

Use of geobotanical methods in groundwater exploration is based on the assumption that areal plant cover characteristics are closely correlated with geological and geo-hydrological conditions. If geobotanical methods are accurate, the areas most useful for well networks and irrigation schemes may be found fairly quickly and inexpensively. A qualitative study attempting to relate differing plant communities to groundwater depth and mineral content was made in the Luni River area of West Rajasthan where groundwater occurs at various depths and is of varied quality. Phreatophytes are extremely useful as indictors of both presence and depth of groundwater. Other plant species associated with the phreatophytes may reflect lithologic and geochemical conditions which in turn are direct or indirect indicators of groundwater quality. Areal maps of groundwater depth and total salt content correlate very closely to the map of plant communities. (Casey-Arizona)
W71-00145

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
John E. Moore, and Leonard A. Wood.
Annals of Arid Zone, Vol 8, No 2, p 225-230, September 1969. 7 fig, 6 ref.

Descriptors: *Analog models, *Hydrogeology, *River flow, *Groundwater basins, *Regional analysis, Model studies, Structural models, Groundwater mining, Withdrawal, Evapotranspiration, Precipitation (Atmospheric), Aquifers, Water wells, Channel flow, Streamflow forecasting, Aquifer characteristics, Water loss, Pumping, Irrigation water, On-site data collections, Channels.
Identifiers: *Arkansas River Valley (Colorado).

The Arkansas Valley of southeastern Colorado overlays a valley fill aquifer consisting of sand, gravel, clay and silt and averaging 3 miles in width. The Arkansas River is hydraulically connected with the aquifer so that the surface water and groundwater of the area constitute a common water supply, During the dry months river flow is often inadequate for irrigation needs and about 234,000 acre-feet of groundwater are therefore pumped from wells. The physical limits and character of the aquifer were described and mapped and quantitative data were obtained on groundwater levels, precipitation, evapotranspiration, and river gains and losses. River losses were greatest in those areas of greatest pumping, indicating that areal groundwater movements were greatly affected by groundwater withdrawal. With the data from field studies and extensive analog model of the Arkansas Valley hydrologic system was built in an effort to predict various withdrawal effects on the regional water economy. Initial results of 2 channel gain and channel loss analog analyses compared closely with field measurements and further water analysis projects are discussed. (Casey-Arizona)
W71-00150

PERMEABILITY OF CRYSTALLINE ROCK INTERPRETED FROM MEASURED ORIENTATIONS AND APERTURES OF FRACTURES,
Ceara Univ., Fortaleza (Brazil). Dept. of Geosciences; and Colorado School of Mines, Golden.
For primary bibliographic entry see Field 07B.
W71-00151

ROCK MOVEMENT TRIGGERED BY A WATER-LEVEL CHANGE IN THE BRUNSWICK AREA, GEORGIA,
Geological Survey, Brunswick, Ga.
Dean O. Gregg.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C198 - C201, 1970. 4 p, 2 fig, 5 ref.

Descriptors: *Water level fluctuations, *Faults (Geology), *Withdrawal, *Land subsidence, *Movement, Earthquakes, Georgia, Structural geology, Stress, Strain, Artesian wells, Hydrogeology.
Identifiers: Brunswick (Ga).

Anomalous water-level fluctuations attributed to rock movement were recorded simultaneously in three wells tapping the principal artesian aquifer in Glynn County, Ga. During the time of the fluctuations, water levels in the area were rising after an industrial shutdown for the 1964 Christmas holidays and a massive reduction in groundwater withdrawals. It is postulated that the rapidly changing pressures superimposed on older unresolved stress conditions may have triggered subsidence of movement along a suspected fault zone. (Knapp-USGS)
W71-00177

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,
Geological Survey, Richmond, Va.
Robert L. Wait.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C202, 1970. 4 p, 2 fig, 5 ref.

Descriptors: *Aquifers, *Aquicludes, *Saline water intrusion, *Mining, *Radioactive well logging, Borehole geophysics, Subsurface mapping, Subsurface investigations, Water pollution sources, Clays, Phosphates, Mine drainage.
Identifiers: Glynn County (Ga), Phosphate mining.

Of four inflection points that occur on gamma-radiation logs from the coastal area of Georgia, three are radiation peaks marking phosphate zones in the Eocene to middle and lower miocene rocks. Point A occurs in a sand at the base of a silty clay confining bed that lies above and protects the principal artesian aquifer from sea-water intrusion. Inflection point D occurs at the contact of the Oligocene and upper Eocene limestones. Mining of the phosphate zone marked by point A would breach the silty clay confining bed above the principal artesian aquifer and would allow intrusion of sea water into it. Such sea-water instrusion would destroy the groundwater resources over a wide area of one of the Nation's largest artesian aquifers and would have dire economic consequences for this area. (Knapp-USGS)
W71-00178

NONSTEADY INFLOW TO A CHAMBER WITHIN A THICK AQUITARD,
Geological Survey, Denver, Colo.
W. W. Dudley, Jr.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C206 - C211, 1970. 6 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Groundwater movement, *Aquitards, *Drawdown, *Water yield, *Transmissivity, Steady flow, Unsteady flow, Artesian wells, Excavation, Tunnel construction, Nuclear explosions, Recharge, Discharge (Water), Dewatering.
Identifiers: Leaky artesian aquifers.

Nuclear devices for underground testing must often be kept dry in chambers excavated in rocks of low permeability thousands of feet beneath the water table. For calculating the time-variable discharge to such a chamber, the chamber interval is arbitrarily treated as an aquifer, although the entire zone actually is an aquitard. Those parts of the aquitard above and below the chamber interval are treated as leaky confining beds. Combining the upper and lower recharge systems into a hydraulically equivalent system with only one recharge source allows the application of a type-curve method developed by Hantush for the constant-drawdown, leaky artesian inflow to a well. (Knapp-USGS)
W71-00179

DETERMINING TRANSMISSIVITY FROM WATER-LEVEL RECOVERY OF A STEP-DRAWDOWN TEST,
Geological Survey, Carson City, Nev.
J. R. Harrill.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C212 - C213, 1970. 2 p, 2 ref.

Descriptors: *Groundwater movement, *Transmissivity, *Drawdown, *Theis equation, *Water level fluctuations, On-site tests, Permeability, Storage coefficient, Unsteady flow, Pumping, Discharge (Water).
Identifiers: Step-drawdown tests, Aquifer testing.

A modified form of the Theis recovery formula provides a means of computing transmissivity from the water-level recovery of a step-drawdown test. This variation of the recovery-test techniques is designed primarily for use where no observation wells are available and where it is not feasible to schedule a separate recovery test in addition to a step-drawdown test. (Knapp-USGS)
W71-00180

A SEMIQUANTITATIVE METHOD FOR DETERMINING THE SOURCE OF SPRING-FLOW IN THE MISSOURI OZARKS,
Geological Survey, Rolla, Mo.
G. L. Feder.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C214-C217, 1970. 4 p, 4 fig, 5 ref.

Descriptors: *Springs, *Discharge (Water), *Recession curves, *Missouri, *Karst, Limestones, Carbonate rocks, Surface-groundwater relationships, Artesian wells, Aquifers, Bast flow, Streamflow, Groundwater movement, Water chemistry, Carbonates.
Identifiers: Ozark Mountains (Mo).

Springflow-recession curves in conjunction with data on carbonate saturation can be used to make semiquantitative determinations of the source of springflow in the terranes of carbonate rock of the Missouri Ozarks. The recession curve having the maximum slope represents rapid local drainage through nearby sinkholes, losing streams, cave networks, and flow from the regional artesian aquifer. The curve also represents periods of maximum regional flow from the aquifer. As the local drainage is depleted, the springflow-recession curve slowly approaches the minimum slope and primarily represents flow from the aquifer. During periods when the springflow-recession curve approaches the maximum slope, the saturation of the water with respect to dolomite is low, reflecting the short residence time of the local drainage. As the minimum slope of the recession curve is approached, the saturation with respect to dolomite increases and reflects the greater distance traveled and the longer residence time of the regional artesian water. (Knapp-USGS)
W71-00181

GEOLOGY AND GROUNDWATER RESOURCES OF PITT COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
Carlton T. Sumsion.
North Carolina Division of Groundwater Bulletin No 18, March 1970. 75 p, 16 fig, 2 plate, 5 tab, 21 ref.

Descriptors: *Hydrogeology, *Aquifers, *Water resources development, *North Carolina, Groundwater, Water resources, Water quality, Water wells, Artesian wells, Water yield, Transmissivity, Withdrawal, Water supply, Water levels, Data collections, Hydrologic data.
Identifiers: Pitt County (NC).

This report describes the geology and groundwater resources of Pitt County in eastern North Carolina. Mean annual precipitation in the county is approximately 48 inches. The topography of the county is typical of the Coastal Plain Province, a flat, sandy plain whose only steep slopes are along stream-valley terraces. Nearly flat-lying surficial sediments of Holocene and Tertiary age overlie strata of Cretaceous age which dip gently to the southeast. Seven major aquifers serve as sources of groundwater. Groundwater is recovered from both confined and unconfined aquifers; large quantities suitable for industrial or municipal supplies are obtained from confined aquifers. Current groundwater withdrawal is only a small percentage of recharge, and nowhere has there been an overdraft. Groundwater in the shallow unconfined aquifer is generally slightly acidic and in many cases contains objectionable amounts of iron. Brackish or saline groundwater is present in these deeper strata in the eastern part of the county. (Knapp-USGS)
W71-00188

THE SIGNIFICANCE OF PERCOLATION WATER IN LIMESTONE CATCHMENTS,
Saskatchewan Univ., Regina. Dept. of Geography.
David P. Drew.
Groundwater, Vol 8, No 5, p 8-11, September-October 1970. 4 p, 2 fig, 1 tab, 16 ref.

Descriptors: *Percolation, *Limestones, *Groundwater movements, *Karst, Aquifers, Dye releases, Tracers, Tracking techniques, Flow, Recharge, Soil water movement, Saturated flow, Unsaturated flow, Hydrogeology.
Identifiers: Percolation water, Limestone hydrology, Karst hydrology.

Water not flowing in major conduits in limestone aquifers is designated 'percolation water'. The importance of percolation water in an area is probably a function of rock type, structure and hydrologic characteristics. Experiments undertaken in England and Jamaica tracing percolation water with Pyranine suggest longer flow-through times than for water sinking at discrete points on the surface. The soil cover in an area may be in part responsible for this delay. Results from percolation water traces may be used to compile isochronal maps of limestone catchments. (Knapp-USGS)
W71-00195

USE OF ALLUVIAL FAULTS IN THE STORAGE AND RETENTION OF GROUNDWATER,
Department of Water and Power, Los Angeles, Calif.
For primary bibliographic entry see Field 04B.
W71-00196

A COMPUTER METHOD FOR PUMPING-TEST ANALYSIS,
New Mexico Tech., Socorro. Research and Development Div.
Z. A. Saleem.
Groundwater, Vol 8, No 5, p 21-24, September-October 1970. 4 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Groundwater movement, *Drawdown, *Water yield, *Pumping, Water wells, Least squares method, Parametric hydrology, Computer programs, Transmissivity, Permeability, Storage coefficient.
Identifiers: Pumping tests, Aquifer evaluation.

A computer method for aquifer evaluation is based on the classifical principle of least squares. The sum of the weighted squares of differences between observed drawdowns and drawdowns calculated using theoretical drawdown equations is minimized, treating the aquifer parameters as decision variables. The method can be applied to any flow system for which analytical expressions for the potential distribution are known. The method was successfully applied to four pumping tests, two in nonleaky confined flow systems, one in a leaky confined flow system and one in an anisotropic nonleaky confined flow system. (Knapp-USGS)
W71-00197

MODEL TESTS FOR A HORIZONTAL WELL,
Yehuda Peter.
Groundwater, Vol 8, No 5, p 30-34, September-October 1970. 5 p, 5 fig, 2 tab.

Descriptors: *Groundwater movement, *Water wells, Water table, *Hydraulic models, Model studies, Water levels, Drawdown, Water yield, Infiltration.
Identifiers: *Horizontal wells.

Goundwater flow into a drilled well, consisting of a vertical shaft and radially spaced horizontal intake pipes was studied using hydraulic model tests. The assumption of linearly distributed inflow based on the steady-flow theory of Darcy-Thiem was tested and found satisfactory. (Knapp-USGS)
W71-00198

DETERMINING THE SUSTAINED YIELDS OF WELLS IN CARBONATE AND FRACTURED AQUIFERS,
Pennsylvania State Univ., University Park. Mineral Conservation Section.
For primary bibliographic entry see Field 04B.
W71-00201

LARGE SPRINGS OF FLORIDA'S 'SUN COAST,' CITRUS AND HERNANDO COUNTIES,
Geological Survey, Tallahassee, Fla.
J. A. Mann, and R. N. Cherry.
Florida Bureau of Geology Leaflet No 9, Department of Natural Resources, 1970. 22 p, 15 fig, 1 tab, 9 ref.

Descriptors: *Springs, *Florida, Discharge (Water), Water yield, Water resources development, Water conservation, Karst, Limestones, Hydrology, Hydrogeology, Saline water-freshwater interfaces, Saline water intrusion.
Identifiers: Sun Coast (Fla), Crystal River (Fla), Homosassa Springs (Fla), Chassahowitzka Springs (Fla), Weekiwachee Springs (Fla).

Four large spring complexes in the west-central gulf coast of Florida provide most of the freshwater flow of Crystal, Homosassa, Chassahowitzka, and Weekiwachee Rivers. Combined flow of the rivers averages or exceeds one billion gallons per day, and could have supplied all of Florida's industrial and municipal water used in 1967. The spring complexes are important to the future development of the area as a tourist attraction (the largest industry) and their esthetic and natural resource value. Completed elements of hydrologic investigations in the area include: (1) extensive field reconnaissance to locate all springs and points of potential spring flow under changing hydrologic conditions; (2) detailed analysis of the amount and variation of the salinity of water from wells in the Crystal River basin; (3) determination of the elevation of the piezometric surface in the Floridan aquifer in the coastal area and approximate location of the line where the groundwater level equals sea level; (4) the continuous monitoring of the flow of Crystal River; and (5) an extensive program of recording the discharge, water level, and chemical quality of water from streams, lakes, springs, sinkholes, and wells. Caution should be used in land development, so that damage to the springs, the hydrologic system feeding them, and the potable water supplies in the aquifer can be avoided or minimized. (Knapp-USGS)
W71-00207

GEOLOGY AND WATER RESOURCES OF CAMPBELL COUNTY, SOUTH DAKOTA; PART III-BASIC DATA,
South Dakota State Geological Survey, Vermillion, and Geological Survey, Vermillion, S. Dak.
Lynn S. Hedges, and Neil C. Koch.
South Dakota Geological Survey Bulletin 20, 1970. 172 p, 3 fig, 5 tab, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *South Dakota, Water wells, Aquifers, Geology, Hydrogeology, Water levels, Observation wells.
Identifiers: Campbell County (S Dak).

Data collected in a study of the geology and water resources of Campbell County South Dakota, are presented. Most of the data for this report were compiled during 1965, 1966, and 1967 and consist of four basic types of information: (1) well inventory data, (2) water-level measurements from observation wells, (3) chemical analyses of water samples from selected wells, and (4) lithologic logs of wells and test holes. A compilation of this data is contained in five tables. (Knapp-USGS)
W71-00210

T-WAVE, A COMPUTER CODE FOR ANALYZING THE NONSTEADY GRAVITY DECAY OF A GROUNDWATER ANOMALY,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 07C.
W71-00211

GEOLOGY AND GROUNDWATER RESOURCES OF DECATUR COUNTY, KANSAS,
Geological Survey, Lawrence, Kansas.
Warren G. Hodson.
Kansas Geological Survey Bulletin 196, December 1969. 41 p, 8 fig, 2 plate, 6 tab, 35 ref.

Descriptors: *Hydrogeology, *Aquifers, *Kansas, Groundwater, Water resources, Water resources development, Data collections, Hydrologic data, Water wells, Water levels, Geology, Stratigraphy, Alluvium.
Identifiers: Decatur County (Kans).

Decatur County is a 900 sq-mi area in the High Plains section of northwestern Kansas. The climate is subhumid to semi-arid, with a mean annual precipitation of 18.42 inches. The Ogallala Formation of Tertiary (Pliocene) age overlies the Cretaceous rocks in the upland areas and is the most widespread aquifer in the county. Stream erosion has removed the Ogallala Formation along the principal valleys, but streams, through several cycles of alluviation, have subsequently deposited the more permeable sediments in the valleys. There are 2 principal aquifers in the county--the Ogallala Formation that underlies the upland areas, and the relatively narrow alluvial deposits in the 4 major stream valleys. The upland areas have more areal extent than the alluvial valleys, but the highest yielding wells are in the major valleys where most of the irrigation is practiced. Based on population figures and livestock statistics, an estimated 750 to 1,000 acre-feet of groundwater is used annually in rural areas for household and livestock purposes. Three cities use a total of about 400 acre-feet of groundwater per year. About 17,000 acre-feet of groundwater is appropriated for the irrigation of 10,500 acres. Groundwater in the county is moderately hard, but its quality is adequate for most purposes. (Knapp-USGS)
W71-00227

WATER RESOURCES OF THE GUAYANILLA-YAUCO AREA, PUERTO RICO,
Geological Survey, San Juan, Puerto Rico.
For primary bibliographic entry see Field 02E.
W71-00228

TREND-SURFACE ANALYSIS OF GROUNDWATER FLUCTUATIONS,
Missouri Univ., Rolla.
John D. Rockaway, Jr.
Groundwater, Vol 8, No 3, p 29-36, May-June 1970. 8 p, 8 fig, 8 ref.

Descriptors: *Groundwater, Groundwater basins, Mathematical analysis, Groundwater geology, Groundwater recharge, Water levels, Hydrogeology, *Water level fluctuations, Water resources, Statistical methods, Water table, Aquifers, Statistical analysis, Contours.
Identifiers: Groundwater potential, Groundwater management, *Trend-surface method, *Groundwater hydrology.

With the objective of developing techniques for guidance in selecting areas suitable for future groundwater resource development, a statistical technique of fitting polynomial trend-surfaces to groundwater levels was applied to a test site in Bartholomew County, Ind. Trend-surface maps and maps of the deviations from trend-surfaces were prepared from water-level data and evaluated to establish their relationships with the hydrogeologic regimen. A field testing program for evaluating aquifer parameters concluded that: (1) A mathematically fitted surface may be considered to approximate the water-table or piezometric surface, and is sensitive to fluctuations in the groundwater reservoir; (2) Anomalous areas of the trend-surface represent local effects superimposed on the regional base and may be explained by a particular set of geologic, hydrologic, or manmade conditions; and (3) Trend-surface analysis of hydrogeologic data is a rapid, inexpensive method for predicting and establishing areas of potential groundwater development. (USBR)
W71-00259

ANALYSIS OF HYDRAULIC TESTS IN HOT CREEK VALLEY, NEVADA,
Geological Survey, Denver, Colo.
George A. Dinwiddie.
Geological Survey Open-file Report USGS-474-82, June 1970. 63 p, 40 fig, 4 tab, 3 ref. USAEC Contract AT (29-2)-474.

Descriptors: *Hydrogeology, *Aquifers, *Igneous rocks, *Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.
Identifiers: Aquifer testing, Well testing, Pumping tests.

An analysis is presented of data obtained during hydraulic tests in exploratory holes, Hot Creek Valley, Nevada. The analysis is focused on determining variations in hydrostatic head in the vertical section; transmissivity, hydraulic conductivity, storage coefficients, and velocity of groundwater movement in selected intervals; and inflow to a theoretical chamber. Hole UCe-17 penetrated alluvium, welded tuff, zeolitized bedded tuff, and tuffaceous sediments. The composite water level was 161.0 meters below land-surface datum. Hole UCe-18 penetrated alluvium, lake beds and gypsum, rhyolite, and bedded tuff. The composite water level was 59.8 meters below land-surface datum. Hole UCe-20 penetrated alluvium, welded tuff, and tuffaceous conglomerate. The composite water level was 65.5 meters below land-surface datum. Inflow to a theoretical cylindrical chamber 3.66 meters in diameter and at a depth of from 1,524.4 to 1,533.5 meters below land surface in UCe-20 was computed using a leaky artesian, constant-drawdown formula. Because of many variables and unique conditions, the computation can be considered only as an approximation. The inflow to the theoretical chamber probably would be about 14 cubic meters per day after an elapsed inflow time of about 70 days. Hole HTH-1 penetrated alluvium, welded tuff, and tuffaceous sediments. The composite water level was 168.6 meters below land-surface datum. Transmissivities ranged from 0.000248 to 43.8 cu m per day per m. (Knapp-USGS)
W71-00306

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00307

GEOLOGY AND GROUNDWATER RESOURCES OF CERRO GORDO COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
H. G. Hershey, K. D. Wahl, and W. L. Steinhilber.
Iowa Geological Survey Water-Supply Bulletin No 9, 1970. 75 p, 24 fig, 1 plate, 10 tab, 41 ref.

Descriptors: *Water resources development, *Iowa, *Groundwater, *Hydrogeology, Aquifers, Water yield, Trnsmissivity, Sandstones, Glacial drift, Water wells, Water quality, Water supply, Industrial water, Municipal water.
Identifiers: Cerro Gordo County (Iowa).

The basic geologic framework underlying Cerro Gordo County, Iowa consists of an igneous or metamorphic Precambrian basement complex overlain by consolidated sedimentary rocks of Precambrian to Cretaceous age, and unconsolidated sand, gravel, and clay of Quaternary age. Groundwater occurs in the sedimentary units of Cambrian through Mississippian age and in the glacial drift and outwash deposits. The chief aquifers are the deep Cambrian sandstones, Jordan aquifer, St. Peter sandstone, Devonian and Mississippian limestone and dolomites, and the Pleistocene glacial drift and related interglacial deposits. Groundwater in Cerro Gordo County is of suitable chemical quality for domestic industrial, or municipal use. The total dissolved solids ranges from 152 mg/liter in water from the shallow bedrock to 885 mg/liter in water from the deep Cambrian sandstones. Municipal pumpage in the county in 1968 was about 1.5 billion gallons; industrial pumpage was about 1.8 billion gallons, and most of the water was obtained from the Jordan aquifer. (Knapp-USGS)
W71-00345

COMPUTATION OF RATE AND VOLUME OF STREAM DEPLETION BY WELLS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W71-00354

GROUNDWATER IN GREENE COUNTY, NEW YORK,
Geological Survey, Albany, N.Y.
William G. Weist, Jr., and Ralph C. Heath.
Greene County Farm and Home News, Vol 53, No 6, p 1, 9-12, June 1970. 5 p, 6 fig.

Descriptors: *Groundwater, *Water resources, Groundwater movement, Aquifers, Aquifer characteristics, Geology, Geochemistry, Water quality, Groundwater recharge, Zone of saturation, Water table, Bedrock, Hydrologic cycle.
Identifiers: Groundwater hydrology, Unconsolidated deposits.

Water in a usable quantity can be obtained from wells in nearly every part of Greene County, New York, and, if the supply is exhausted through excessive use during the summer and fall, it will be replaced during the winter and spring. These desirable features sometimes lead to undesirable practices of waste and pollution. Groundwater is obtained in the county from both the bedrock and from the unconsolidated deposits that cover the bedrock. From the standpoint of groundwater, all the bedrock in Greene County can be lumped into three types: (1) shale, (2) carbonate rocks (such as limestone), and (3) sandstone. The unconsolidated deposits also can be lumped into three units: (1) clay and silt, (2) sand and gravel, and (3) till. Pertinent terminology is explained to insure a better understanding of groundwater hydrology. (Woodard-USGS)
W71-00363

STEAM INJECTION, OIL RECOVERY TECHNIQUES, AND WATER QUALITY,
Orange County Water Pollution Control Dept., Santa Ana, Calif.; and Orange County Flood Control District, Santa Ana, Calif.
For primary bibliographic entry see Field 05G.
W71-00371

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA,
Geological Survey, Washington, D.C.
John R. Williams.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $1.00. Geological Survey Professional Paper 696, 1970. 83 p, 25 fig, 4 tab, 270 ref.

Descriptors: *Permafrost, *Alaska, *Water resources development, *Groundwater, *Aquifers, Groundwater movement, Water quality, Water yield, Water supply, Ice, Frozen soils, Frozen ground, Saline water intrusion, Alluvium, Alluvial channels, Hydrogeology.
Identifiers: Permafrost hydrogeology.

Although groundwater in permafrost regions in Alaska occurs according to the same geologic and hydrologic principles prevailing in temperate regions, subfreezing temperatures result in profound modification of groundwater flow systems. Frozen ground is an impermeable layer which: (1) Restricts recharge, discharge, and movement of groundwater, (2) acts as a confining layer, and (3) limits the volume of unconsolidated deposits and bedrock in which liquid water may be stored. Frozen ground in many areas eliminates shallow aquifers and requires that wells be drilled deeper than in similar geologic environments having no permafrost. Local variations in the thickness, areal extent, and temperature of permafrost depend on variable thermal properties of earth materials and on local differences in the rate of heat flow from within the earth, climate, topography, vegetation,

geology, and hydrology. Groundwater occurs above, below, and locally within, permafrost. In the continuous-permafrost zone, the most economically developed sources of water are in unfrozen alluvium beneath large lakes and rivers. In the discontinuous-permafrost zone, groundwater is produced locally from shallow aquifers above permafrost of offshore bars and spits because water within or below the frozen beach deposits is saline. (Knapp-USGS)
W71-00373

2G. Water in Soils

THEORY OF FLOW TO DRAINS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02F.
W71-00007

TWO-LIQUID FLOWS IN POROUS MEDIA,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02F.
W71-00009

PHASE BOUNDARY WATER IN FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
Duwayne M. Anderson.
Army Cold Regions Research and Engineering Laboratory Research Report 274, May 1970. 19 p, 8 fig, 41 ref. DA Task No 1T061102B52A02.

Descriptors: *Frozen soils, *Ice, *Water chemistry, *Crystallography, *Water structure, Boundary processes, Ion transport, Soil structure, Soil chemistry, Freezing, Thawing, Crystallization, Water of hydration, Silicates, Clay minerals, Ion transport, Mass transport, Osmosis.
Identifiers: Ice-soil-water relationships.

Water at phase boundaries plays an important and in some cases the dominant role in governing heat and mass transport, electrical conduction, transmission of compression waves and other processes of importance in frozen soils. This report summarizes presently accepted concepts and information, and discusses significant advances in knowledge. Interfacial regions in frozen soils are of the following types: ice/ice (grain boundary), ice/water/air, silicate/water/silicate (interlamellar), and silicate/water/ice (extralamellar). The liquid portion of the interfacial region should be regarded as a liquid-like solution of the ionic and undissociated substances sorbed by the interface and expelled from the ice during freezing. In spite of strong interfacial forces, the interfacial water exhibits liquid-like mobility in its response to many kinds of driving forces. A zone of strong perturbation and disorder exists immediately proximate to silicate surfaces; protons of water molecules are partially delocalized and more easily dissociated. At a distance of 2 or 3 molecular diameters away from the silicate surface, the interfacial forces create a zone of enhanced order. At some farther distance, there exists a disordered transition zone similar to the ice surface as portrayed in Drost-Hansen's model. (Knapp-USGS)
W71-00044

DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00068

ORIGIN AND GEOMORPHOLOGY OF THE THAR DESERT,
Ranchi Univ. (India). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-00149

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
For primary bibliographic entry see Field 03B.
W71-00152

OBSERVATIONS ON WATER-REPELLENT SOILS IN WESTERN UNITED STATES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 17-29, March 1969. 3 fig, 2 tab, 10 ref.

Descriptors: *Absorption, *Wettability, *Soil texture, *Repellents, Ecosystems, Penetration, Soil types, Soil moisture, Soil horizons, California, Soil texture, Vegetation, Topography, Soil-water-plant relationships, Diffusivity, On-site investigations, Drops (Fluids).
Identifiers: *Water-repellent soils, *Liquid-solid contact angle, *Water drop penetration time, Penetrants.

Although most soils show high affinities for water, some exhibit varying degrees of water-repellency. The degree of water repellence of a given soil may be tested by the water drop penetration time method in which a drop of water is placed on a soil sample and the time interval before absorption of the droplet by the soil is measured. Many workers classify a soil as water-repellent or non-wettable if penetration time is greater than 5 seconds. Other methods of characterizing soil repellency are measurements of the liquid-solid contact angle and diffusivity. Early and continuing observations on water-repellent soils have been made on burned over and unburned watersheds in California where surface runoff is affected. Studies of many areas in the western U. S. have shown a wide distribution of water-repellent soils ranging from alpine areas to low semiarid brushlands. Water repellency may be at least in part a function of soil texture. Coarse, sandy soils have a greater surface area for coating by a hypothesized hydrogen-bonded organic polymer. (Casey-Arizona)
W71-00154

WATER-REPELLENT SOILS IN SOUTHERN CALIFORNIA,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
C. Steven Holzhey.
Supported by U.S. Department of Agriculture, Forest Service, Grant No. 4000. In: Symposium on Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 31-41, March 1969. 3 fig, 1 tab, 9 ref.

Descriptors: *Wettability, *Soil horizons, *Vegetation effects, *Topography, *Climates, *Ecosystems, Repellents, Plant groupings, Chaparral, Arid lands, Mountains, Mosses, Xerophytes, Shrubs, Trees, California, Rainfall, Runoff, Temperature, On-site investigations, Soil surfaces, Seasonal, Subtropic.
Identifiers: *Water-repellent soils, *Subtropical climates, *Herbs, Mesophytes.

Soil water repellence is mainly a function of soil surface horizons and may be either year-round or seasonal. Surface horizons are in turn strongly influenced by vegetation. There are 3 main climatic regions in southern California--inland desert, low elevation marine and high elevation mountain climates. The soil of the mountain regions is rich in decomposing litter from woody plants and water repellence is year-round. As trees and shrubs grade at lower elevations into chaparral, which then grades into Mediterranean-type, herb-dominated coastal communities, water repellence concurrently grades from year-round to strictly seasonal. During the long rainless coastal summer, repellence is minimal but increases sharply during the rainy season. Generally, very dry soils show little repellence. In some areas, ground mats of lichens, liverworts and moss-like species provide seasonal water-repellent cover, promoting runoff. In locales of year-round repellence, coarser sandy soils prevail. Repellent soils also occur in desert-scrub communities, but have been little studied. (Casey-Arizona)
W71-00155

MEASUREMENT OF CONTACT ANGLE, WATER DROP PENETRATION TIME, AND CRITICAL SURFACE TENSION,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. Letey.
Partially supported by U.S. Department of Agriculture, Forest Service, Grant No. 4000. In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 43-47, March 1969. 1 fig, 3 ref.

Descriptors: *Wettability, *Soil physics, *Surface tension, *Capillary action, Pores, Infiltration, Repellents.
Identifiers: *Liquid-solid contact angle, *Critical surface tension, *Water-repellent soils, Ethanol, Effective pore radius.

The liquid-solid contact angle has been one method of characterizing water repellency on plane surfaces, but it cannot be measured within a soil system. The height of capillary rise is a function of the liquid-solid contact angle. It is also a function of pore radius, which is difficult to measure. However, by using ethanol, which has a contact angle of 0, the pore radius can be determined and used to calculate the water contact angle. The water drop penetration method is based on the assumption that the contact angle must be greater than 90 degrees on repellent substances. It is a difficult method to use because the contact angle changes with time. The contact angle is also dependent on the liquid surface tension and in general decreases as surface tension decreases. Critical surface tension is a property of the solid, and the higher it is, the less water repellent the material is. Critical surface tension measurements of soils may lead to a simple efficient repellency indicator, but more research is needed. (Casey-Arizona)
W71-00156

WATER-REPELLENT SOILS AND WETTING AGENTS AS FACTORS INFLUENCING EROSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. S. Krammes, and J. Osborn.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 177-187, March 1969. 1 fig, 2 tab, 13 ref.

Descriptors: *Watersheds (Basins), *Wettability, *Soil erosion, *Runoff, *Cost-benefit ratio, Chaparral, Semiarid climates, Mountains, California, Repellents, Debris avalanches, Infiltration, Grasses, Economic justification, Surfactants, Soil-water-plant relationships, Burning, Erosion control, Vegetation regrowth.
Identifiers: *Water-repellent soils, *Wetting agents, Burned-over sites, Plots.

Southern California's steep, unstable, chaparral-covered mountain watersheds often suffer devastating fires followed by great increases in rainfall runoff, debris and soil erosion. Soil tests indicated high soil water-repellence in these areas. It was therefore decided to experiment with surface wetting agents on burned over plots in the San Dimas Experimental Forest. Three plots were treated with 6.6 gallons of alkyl-polyoxyethylene ethanol per acre, resulting in: (1) 95 percent reduction in debris movement, (2) 32 percent runoff reduction after 5 moderate intensity rainstorms and (3) greatly increased grass growth. The lessened

runoff and increased soil moisture probably resulted in more grass seed retained in the area together with better germination conditions. In subsequent years both liquid and granular wetting agents were applied to burnouts in differing areas, usually with similar results. Treatments in one area reduced not only debris yield but also dry crop erosion. In the Los Angeles County Flood Control District the treatment benefit/cost ratio was about 2.5:1. Available data indicate a treatment effectiveness span of about 1 year. The results argue for selective applications in highly erodible areas with water-repellent soils. (Casey-Arizona)
W71-00157

WATER-REPELLENT SOILS AND ANNUAL PLANT COVER IN A DESERT SCRUB COMMUNITY OF SOUTHEASTERN CALIFORNIA,
California Univ., Riverside. Dept. of Life Sciences.
Susan Adams, B. R. Strain, and M. S. Adams.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 289-295, March 1969. 5 fig, 5 ref.

Descriptors: *Plant populations, *Xerophytes, *Wettability, *Repellents, *Soil properties, Plant groupings, Plant growth, Arid lands, On-site investigations, Physical properties, Condensation, Surveys, Shrubs, Trees, Stemflow, California, Soil-water-plant relationships, Volatility, Drops (Fluids), Vegetation, Burning, Vegetation regrowth.
Identifiers: *Water-repellent soils, Plant annuals, Plant distribution, Hummocks, Volatilization, Burned-over sites, Scrub.

Fire in a desert scrub area which produced a post-fire vegetational mosaic suggesting annual plant distribution was related to the occurrence of hydrophobic soils. To investigate this possibility plant surveys were conducted on burned and unburned Prosopis, Larrea and Cercidium hummocks. Simultaneously, soil water repellency measures were made using the drop test. In all cases hydrophobic layers were most concentrated around stem areas and were deeper in burned hummocks. These effects were somewhat less pronounced in Cercidium hummocks. Probably greater concentrations around stems resulted from stemflow. The deeper hydrophobic soil depths on burned ground probably indicate the volatilization of some substance during fires followed by condensation at greater depths. If discontinuous, these repellent layers could act to trap and hold soil water around root zones. The distribution on burned soils was uneven, with abrupt transitions to continuous distributions at unburned boundaries. Again, this effect was less emphatic around Cercidium hummocks. Distributions were largely continuous around unburned hummocks. (Casey-Arizona)
W71-00158

NATURAL ORGANIC ACIDS AS AGENTS OF CHEMICAL WEATHERING,
Geological Survey, Denver, Colo.; and Colorado School of Mines, Golden. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-00174

EVALUATION OF INSTALLATION METHODS FOR NEUTRON-METER ACCESS TUBES,
Geological Survey, Idaho Falls, Idaho; and Geological Survey, Denver, Colo.
W. E. Teasdale, and A. I. Johnson.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C237-C241, 1970. 5 p, 7 fig, 5 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, Nuclear meters, Moisture content, Soil moisture, Instrumentation, On-site tests, Boreholes.
Identifiers: Neutron-meter access tubes.

A detailed study evaluated various methods for installing access tubes for a depth-type neutron-meter probe. At a small test site, soil-moisture content was determined by laboratory analysis of undisturbed volumetric samples as well as by means of a neutron-meter probe. Installation of thin-walled aluminum tubes of approximately the same diameter as that of the probe, in a hole small enough for tight contact between tube and soil, yielded the most favorable results. However, other less complicated and more economical methods of installing access tubes could be used with reasonable accuracy, if neutron-meter measurements made at the installation were calibrated against volumetric sampling at the site. Because of the depths involved in groundwater studies one of the simpler, more economical installation methods is more practical than the skintight-fit method and at the same time provides a reasonable degree of accuracy in the measurement of change in the moisture content of soils. (Knapp-USGS)
W71-00187

THE SIGNIFICANCE OF PERCOLATION WATER IN LIMESTONE CATCHMENTS,
Saskatchewan Univ., Regina. Dept. of Geography.
For primary bibliographic entry see Field 02F.
W71-00195

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02D.
W71-00370

RELATION OF PERCOLATION RATES TO SOIL TEXTURE ON SEVERAL INDIANA SOILS,
Soil Conservation Service, South Bend, Ind.; and Purdue Univ., Lafayette.
Ival D. Persinger, and Joseph E. Yahner.
Journal of Soil and Water Conservation, Vol 25, No 5, p 189-191, September-October 1970. 3 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Soil texture, *Percolation, *Indiana, *Soil water movement, *Soil surveys, Planning, Urbanization, Land use, Soil conservation, Land development, Land management, Erosion control.
Identifiers: Land use planning.

A study was conducted in St. Joseph County, Indiana, to determine the relationship between percolation rate and soil texture. Forty sites were selected on nine soil series and relationships developed by regression analysis. A highly significant correlation was obtained on these glacial outwash, glacial till and lacustrine soils. The study determined that planning groups could use soil texture inferred from soil maps as a substitute for percolation rates. (Knapp-USGS)
W71-00392

THICKNESS OF SOIL SOLUM AS A PARAMETER OF PLANT-AVAILABLE WATER STORAGE CAPACITY IN SOILS UNDERLAIN BY CARBONATE ROCKS,
Missouri Water Resources Research Center, Columbia.
C. L. Scrivner, and D. A. Ruppert.
Available from NTIS as PB-195 085, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, Aug 10, 1970. 111 p, 11 tab, 33 fig, 38 ref, 3 append. OWRR Project No B-022-MO (2).

Descriptors: *Soil, *Soil water, *Limestone, *Clay content, Chert, Prairie, Forest.
Identifiers: Available water, Observed field capacity, 15 bar water, Natural vegetation, Neutron probe.

Available water storage capacities were determined by field measurement in limestone-derived soils with a range in depths to carbonate rock of 15 cm to more than 300 cm. Neutron probe access wells were installed and amounts of water were determined throughout two growing seasons. Each soil layer had a characteristic volume of water (called observed field capacity) after recharge by rain periods. At maximum depletions, water approached 15 bar contents. Equations were developed for the prediction of available water (the volume difference between observed field capacity and 15 bar water) from three soil variables; clay content, chert-stone content and depth to carbonate rock. When effects of chert and clay were accounted for the prediction equation was: Total A.W.C. — 0.11 (cm depth - 102). Depths to limestone of less than 61 cm (67 cm A.W.C.) were too shallow to support forest canopies and the natural vegetation was prairie. Forest species survived where depths were greater than 61 cm and some depletion was observed at greater than 250 cm depth. (Scrivner-Missouri)
W71-00414

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
For primary bibliographic entry see Field 08A.
W71-00441

PHASE BOUNDARY WATER IN FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00462

2H. Lakes

COMPUTATION FOR CIRCULATION IN STRATIFIED LAKES,
Cornell Univ., Ithaca, N.Y. School of Civil Engineering.
Kwang K. Lee, and James A. Liggett.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7634, p 2089-2115, October 1970. 27 p, 8 fig, 17 ref, 2 append.

Descriptors: *Water circulation, *Density stratification, *Thermal stratification, *Lakes, *Mathematical models, Stratified flow, Winds, Currents (Water), Hypolimnion, Epilimnion, Topography, Mixing.
Identifiers: Stratified lakes, Upwelling.

A mathematical method is developed for calculating the steady-state, three-dimensional, wind driven circulation in a large stratified lake of arbitrary bottom topography and shape on a rotating earth. The stratification is modeled by a two-layer structure in which the hypolimnion and the epilimnion are considered as two distinct layers with different densities and eddy viscosities. The thermocline location responds sensitively to the applied wind stress and has an important effect on the circulation velocity. An off-shore wind is the primary cause of the cold water up-welling near the shore due to the movement of thermocline. The surface current velocity generally has a smaller magnitude and greater deflection angle than in the homogeneous case except near the boundaries. The volume transport is strong and in the downwind direction near the shore in the epilimnion and near the deep center in the hypolimnion. (Knapp-USGS)
W71-00014

IMPLICATIONS OF A TYPE OF EMPIRICAL EVAPORATION FORMULA FOR LAKES AND PANS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02D.
W71-00024

REGIONAL GROUNDWATER FLOW BETWEEN LAKE SIMCOE AND LAKE ONTARIO,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W71-00031

THE INFLUENCE OF LAKE LEVEL FLUCTUATION AND THE THERMOCLINE ON WATER CHEMISTRY IN TWO GRADUALLY SHELVING AREAS IN LAKE KARIBA, CENTRAL AFRICA,
Nuffield Lake Kariba Research Station (Rhodesia).
S. M. McLachlan.
Archiv fur Hydrobiologie, Vol 66, No 4, p 499-510, 1970. 4 fig, 2 tab, 15 ref.

Descriptors: *Lakes, *Water level fluctuations, *Thermocline, *Water chemistry, Hydrogen ion concentration, Dissolved oxygen, Alkalinity, Conductivity, Potassium, Carbon dioxide, Sampling, Depth, Thermal stratification, Grasses, Fertilizers, Calcium, Magnesium, Ions, Temperature, Seasonal, Sodium, Phosphates, Benthic flora, Aquatic plants.
Identifiers: *Shelving areas, *Lake Kariba (Africa), Exposed flats, Bottom water, Salvinia auriculata, Potamogeton pusillus, Ludwigia stolonifera, Eragrostis, Inundation, Chironomid.

Lake level fluctuation of Kariba is basically used to control flood waters; a secondary result is naturally induced 'fallowing' of the gradually shelving areas. During 1964-1966 surface and bottom water samples from a number of depth zones between 20 centimeters and 20 meters were collected from two gradually shelving areas. With exception of the 20 centimeter and 20 meter zones, samples from all horizontal depth zones were chemically similar throughout the study period. Effects of thermal stratification, involving a decrease in pH and dissolved oxygen content and an increase in carbon dioxide, were detected in bottom water samples from the 20 meter station during the hot months, September to March. When the lake level rose, it inundated terrestrial grass and dung, and considerable changes were recorded in extremely shallow water (20 centimeters): low pH and oxygen content, high conductivity, alkalinity, carbon dioxide, concentration of potassium ions and to a lesser extent, calcium and magnesium. Although transient and restricted to gently shelving areas, these changes resulting from an annual lake level fluctuation provide a valuable source of nutrients to Lake Kariba. (Jones-Wisconsin)
W71-00101

BIOLOGICAL AND CHEMICAL INVESTIGATIONS ON THE EFFECT OF SEWAGE ON THE EUTROPHICATION OF BAVARIAN LAKES,
H. Liebmann.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 7 p, 5 fig, 1 tab, 27 ref.

Descriptors: *Sewage, *Eutrophication, *Lakes, Aquatic environment, Chemical properties, Phosphorus, Nitrogen, Potassium, Diversion, Algae, Nitrogen fixation, Plankton, Phytoplankton, Bacteria, Zooplankton, Salmonids, Season, Oxygen, Hydrogen sulfide, Distribution, Nannoplankton, Turbidity, Hydrogen ion concentration, Alkalinity, Carbonates, Hardness (Water), Sulfates, Conductivity, Sediments, Tertiary treatment, Nutrients.
Identifiers: *Bavaria, Schliersee, Tegernsee, Anabaena, Coregons, Lyngbya limnetica, Oscillatoria redeckei, Oscillatoria rubescens, Synedra acus, Rhodomonas, Lake Constance, Sewage canals.

Lakes Schliersee and Tegernsee in upper Bavaria were assessed for eutrophication by comparing chemical and biological characteristics before and after sewage diversion. By tertiary treatment with chemical flocculation about 90% phosphorus removal is possible, but a phosphorus residue and a relatively high amount of nitrogen remain. Thus, full canalization around the lakes and discharge of the rapidly flowing effluent after biological treatment appeared the most effective method to achieve improvement. Because climatic conditions preclude pumping sewage for great distances in middle Europe, a proposal was made that local purified sewage effluents be pumped into plastic pipes, submerged in Lake Constance for the shortest routing, where a tertiary treatment with phosphorus removal should be established for the whole sewage. Tertiary treatment may be especially advantageous if there are other lakes and impoundments downstream. Danger that leakage from plastic pipelines may introduce purified sewage into the lake seems minimal when compared to the fact that other possible solutions to the problem may defer the remedy for so long that the eutrophication processes become almost irreversible. (Jones-Wisconsin)
W71-00117

CONTRIBUTION OF RANGE LAND RUNOFF TO LAKE EUTROPHICATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
F. R. Campbell, and L. R. Webber.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 6 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Eutrophication, *Runoff, *Ranges, Nitrogen, Phosphorus, Silica, Seasonal, Lakes, Sampling, Potassium, Aquatic weeds, Water quality, Aquatic weed control, Agricultural watersheds, Sediments, Harvesting, Dredging, Control, Analytical techniques, Nutrients.
Identifiers: Canal Lake (Canada), Myriophyllum spicatum.

Canal Lake (Ontario) is partially defined relative to water quality, weed growth, and nutrient loadings during May 1968-May 1969 inflows. Precipitation contributes directly 73% of nitrogen found in major streams discharging into the lake. Agricultural sources of nitrogen contribute about 0.565 pounds/acre, a figure less than 1/5th of the lowest nitrogen estimate in drainage from a nonfertilized agricultural area. About 1/3rd of the total phosphorus entering Canal Lake presumably originated in insoluble organic forms from weed growth. The nitrogen and phosphorus load in Canal Lake, excluding sediments, is about ten times the annual nitrogen and phosphorus stream inflow. This concentration of phosphorus, higher than in inflowing streams, indicates another phosphorus source sufficient to overcome the diluting streamflow effect. Perhaps the greatest sources of nutrients lie within the lake itself: fall-spring filling and retaining a high nutrient inflow percentage, lake sediments, and decay and release of nutrients from aquatic plants. Septic tanks and weeping tiles are probable nutrient sources. A solution would be prevention of further plant nutrient additions and removal of those present. Chemical controls may be temporarily effective locally. Dredging programs may be warranted. (Jones-Wisconsin)
W71-00118

RECONNAISSANCE BATHYMETRY OF PYRAMID LAKE, WASHOE COUNTY, NEVADA,
Geological Survey, Washington, D.C.
E. E. Harris.
For sale by US Geological Survey, Washington, DC, 20242--Price $0.50. Geological Survey Hydrologic Investigations Atlas HA-379, 1 sheet, 1970. Text, 3 fig, 2 tab, 2 ref.

Descriptors: *Lakes, *Nevada, *Surveys, *Bathymetry, Contours, Depth, Lake morphometry, Measurement, Sounding.
Identifiers: *Pyramid Lake (Nev).

Pyramid Lake, about 30 miles northeast of Reno, Nev., is the terminal water body of the Truckee River system. The principal inflow to the lake is from the Truckee River; local drainage around the lake contributes little. The only outflow is by evaporation. Diversions from the Truckee River for irrigation began about 1860, and they were accelerated considerably following construction of the Truckee Canal in 1905. From 1909 to 1968 the lake level declined from an altitude of 3,869 feet to 3,789 feet above sea level, or 80 feet in 59 years. For the present bathymetric survey, section corners and east-west section lines were used to locate accurately the present shoreline and control points for the fathometer survey grid. A boat-mounted recording fathometer was used to obtain cross-sectional profiles of the lake bottom. Twenty-three cross-sectional profiles were run in an east-west direction at one-mile intervals. One long profile was run roughly north-south from The Needle Rocks to Anaho Island. Aerial photography was obtained to provide details on the present shoreline configuration. The fathometer profiles and aerial photographs were used to contour the lake bottom. (Knapp-USGS)
W71-00189

A METHOD FOR OBTAINING ANALYTICAL SOLUTIONS TO THE EQUATION FOR WIND-DRIVEN CIRCULATION IN A SHALLOW SEA OR LAKE,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Marvin E. Goldstein, Willis H. Braun, and Richard T. Gedney.
For sale by NTIS as NASA TN D-5989, price $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note, NASA TN D-5989, September 1970. 56 p, 13 fig, 11 ref.

Descriptors: *Water circulation, *Lakes, *Winds, *Currents (Water), *Seiches, Topography, Lake basins, Lake beds, Lake morphology, Wind pressure, Wind velocity, Wind tides, Equations, Mathematical studies.
Identifiers: Ekman drift, Lake circulation.

A technique is given for obtaining solutions to a class of partial differential equations including Welander's equation for the wind-driven circulation in shallow seas and lakes. The technique, together with some results based on conformal mapping, is used to solve Welander's equation for a closed body of water. To illustrate the principles involved, the method is used to obtain the complete analytical solution for an elliptically shaped body of water with a particular choice of bottom topography when the depth is greater than one-half the Ekman friction depth. (Knapp-USGS)
W71-00192

SILICATE MINERAL STABILITY AND MINERAL EQUILIBRIA IN THE GREAT LAKES,
Syracuse Univ., N.Y. Dept. of Geology.
Jeffery C. Sutherland.
Environmental Science and Technology, Vol 4, No 10, p 826-833, October 1970. 8 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Water chemistry, *Great Lakes, *Silica, *Clay minerals, Equilibrium, Saturation, Leaching, Glacial drift, Aqueous solutions, Mineralogy, Provenance.
Identifiers: Mineral equilibria (Lake water).

Equilibrium concepts involving silicate minerals and water are applied to chemical data from the North Channel and Lakes Erie, Ontario, and Huron, for understanding of chemical self-regulation in the Great Lakes. Equilibria involving silicates and water are inferred from aqueous chemical data. Concentrations of dissolved silica in surface waters of the remote lakes are attained through dissolution of kaolinite. In deeper waters, metastable equilibria, Ca montmorillonite — gibbsite and muscovite — gibbsite may impose upper limits upon concentrations of silica. Silica concentrations in the enclosed waters of sediments from North Channel reach metastable equilibrium with

amorphous silica. The major chemical character of the Great Lakes is inherited from the carbonate-silicate mineralogy of bedrock, soils, and glacial drift in their drainage. (Knapp-USGS)
W71-00204

DRIFT-BOTTLE STUDY OF THE SURFACE CURRENTS OF LAKE SUPERIOR,
Northern Michigan Univ., Marquette; and Michigan Univ., Ann Arbor.
John D. Hughes, John P. Farrell, and Edward C. Monahan.
Michigan Academician, Michigan Academy Science, Arts and Letters, Vol 2, No 4, p 25-31, Spring 1970. 7 p, 2 fig, 6 ref.

Descriptors: *Currents (Water), *Lake Superior, *Data collections, *Drift bottles, Drifting (Aquatic), Flow, Hydrologic data.
Identifiers: Lake Superior currents.

A total of 2436 drift bottles has been released from 205 different stations in Lake Superior since 1966. By Jan. 1, 1969, 237 drifters were returned out of the 2436 released--an overall return of 11 percent. There appears to be a general counter-clockwise current around the entire perimeter of the lake. A broad current flows eastward along the entire south shore during all seasons that drifters were put into the lake. When this current reaches the southeastern corner of the lake it turns counter-clockwise and follows the eastern shore as far as Rossport, in the northernmost part of the lake. From Rossport the current continues its counter-clockwise movement around the lake by turning southwestward but drifts away from the shoreline as it encounters bottom water that wells upward along the entire northwestern side of the lake. (Knapp-USGS)
W71-00212

COMPETITIVE RECREATIONAL USES OF SELECTED IOWA LAKES,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 06B.
W71-00230

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-00355

THE LATERIAL DISTRIBUTION OF CLAY MINERALS IN LAKES PONTCHARTRAIN AND MAUREPAS, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-00391

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.
For primary bibliographic entry see Field 05B.
W71-00397

WHITE SUCKER SPAWNING AND CULTURE OF THE YOUNG IN THE LABORATORY,
National Water Quality Lab., Duluth, Minn.
John G. Hale.
The Progressive Fish-Culturist, Vol 32, No 3, p 169. FWQA Project ETK 18050 ---9/70.

Descriptors: *Fish reproduction, Life history, Studies, *Spawning, Fish diets, Fish growth, Bioassay methods.
Identifiers: *Fish culture, Catostomus commersoni.

White suckers (Catostomus commersoni) collected from a lake inlet were placed in a rectangular tank at inlet water temperature (16C) and provided with a coarse gravel substrate. About 40 hours after the fish had been placed in the tank, eggs were found and after 7 days hatching was about 90 per cent complete. Larval fish were offered live brine shrimp and ground commercial trout starter 3 days after hatching. Seven days after hatching brine shrimp were found in 54 per cent of the fish; trout starter in only 15 per cent. About 1 month after hatching, commercial trout granules (No. 1) and trout starter were fed at a 50:50 ratio, replacing the brine shrimp. Thereafter, the trout food was found in 90 to 95 per cent of the stomachs. One week after hatching, the fish were 12 to 13 millimeters long; 3 months later they were 20 to 34 millimeters long. (Hale-FWQA)
W71-00408

EFFECTS OF ZOOPLANKTON ON PHOTOSYNTHESIS BY ALGAE IN LAKES,
Richmond Univ., Va. Dept. of Biology.
John W. Bishop.
Completion Report, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, October 1970. 4 p. OWRR Project No A-022-VA (1).

Descriptors: Aquatic productivity, *Vertical migration, Impounded waters, Lakes, *Zooplankton, *Algae, *Photosynthesis.

The objective was to measure the extent to which zooplankton control natural populations of algae. Algae with different concentrations of zooplankton were enclosed in aquariums in Westhampton Lake, Virginia. Properties of the water, algae and zooplankton within and without the aquariums were measured over several days. Of the zooplankton examined, rotifers, cladocerans and copepods, only rotifers significantly affected photosynthesis. Rotifers at a concentration of 1,000 animals liter-1, the average for the summer, decreased photosynthesis 0.125 ppm 0 sub 2 hr-1 daily. This value represents 22% of the average rate of photosynthesis. None of the zooplankton significantly affected photosynthetic efficiency, photosynthesis per unit chlorophyll. Daily variations in photosynthesis were correlated with rainfall. Photosynthesis increased several days after rainfall. The increase resulted not from increased chlorophyll, but from increased photosynthetic efficiency of the algae. (Bishop-Richmond)
W71-00416

MATHEMATICAL MODEL OF SIMPLEST HYDROECOLOGICAL SYSTEM,
For primary bibliographic entry see Field 06A.
W71-00440

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
For primary bibliographic entry see Field 05C.
W71-00475

2I. Water in Plants

REVEALING BY PHYSICAL PROCEDURE THE SHORT-DURATION FLUCTUATIONS IN THE DENSITY OF VEGETATION OF MOUNTAIN STREAMS. DEFINITION OF A NEW BIOLOGICAL TEST IN WATER ANALYSIS, THE BIOCHEMICAL DEMAND FOR MINERAL SALTS (IN FRENCH),
Bernard Serra-Tosio.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 1167-1170, 1970. 1 fig, 4 ref.

Descriptors: *Streams, *Sampling, *Aquatic plants, Analytical techniques, Water analysis, Biochemistry, Nutrient requirements, Demineralization, Phytoplankton, Test procedures.
Identifiers: Biological activity, Mineral salts, 'Nychthemeralic' drift, Biological test, Aquatic vegetation density.

Analyses of river water performed in 4-hour intervals have indicated that variation in the concentration of soluble salts is correlated with the time of sampling and corresponding biological activity. Incubation of water samples in the laboratory for 4 to 6 days at 20-23C produced a considerable demineralization of water which nevertheless exhibited a similar diurnal variation in its salt concentration. The differences between the results of analyses, performed at the same time of day and expressed in milligram/liter, are designated as the biochemical demand for mineral salts. Determination of this value is said to provide a picture of the diurnal 'drift' in vegetation density. (Wilde-Wisconsin)
W71-00104

GEOBOTANICAL STUDIES IN GEO-HYDROLOGICAL SURVEYS IN THE ARID ZONE OF W. RAJASTHAN,
Central Arid Zone Research Int., Jodhpur (India).
For primary bibliographic entry see Field 02F.
W71-00145

RESPONSE OF AGRICULTURAL CROPS TO FLOODING, DEPTH-OF-WATER TABLE AND SOIL GASEOUS COMPOSITION,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 03F.
W71-00217

EFFECT OF SOIL WATER STRESS AND SOIL TEMPERATURE ON TRANSLOCATION OF DIURON,
Oregon State Univ., Corvallis. Dept. of Soils.
R. H. Sedgley, and L. Boersma.
Weed Science, Vol 17, No 3, p 304-306, July 1969. 3 p, 2 fig, 1 tab, 10 ref. OWRR Project B-001-ORE (1).

Descriptors: *Path of pollutants, *Herbicides, *Translocation, Weed control, Wheat, Soil moisture, Soil temperature, Pesticide kinetics, Soil water movement, Osmosis, Moisture stress, Water requirements.
Identifiers: Diuron.

Rates of photosynthesis, respiration, and transpiration of wheat were determined as functions of time, under controlled conditions of moderate soil water stress and soil temperature, after treatment of the roots with 3-(3, 4-dichlorophenyl)-1, 1-dimethylurea (diuron). Air temperature, relative humidity, light intensity, and air movement were maintained constant. The rate of photosynthesis declined with time for all plants treated with diuron but not for the controls. No change in the rate of respiration was detected. The rate of transpiration decreased slightly immediately upon application of the diuron and then remained constant. Soil temperature and soil water stress play important roles in the herbicidal action of diuron applied to the soil. (Knapp-USGS)
W71-00226

THE NUTRIENT CYCLES OF AN ECOSYSTEM,
Forest Service (USDA), Laconia, N.H. Hubbard Brook Experimental Forest.
For primary bibliographic entry see Field 02K.
W71-00374

AN ANNUAL REPORT OF THE CHEMICAL CONTROL OF ALLIGATORWEED,
University of Sourthwestern Louisiana, Lafayette. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 04A.
W71-00396

EVAPOTRANSPIRATION AS AFFECTED BU PLANT DENSITY AND WATER-TABLE DEPTH,
Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab.
For primary bibliographic entry see Field 02D.
W71-00402

OCEAN PHOTOSYNTHESIS. EFFECTS OF HYDROSTATIC PRESSURE ON PHOTOSYNTHESIS AND GROWTH OF UNICELLULAR MARINE ALGAE AND DIATOMS,
Hawaii Univ., Honolulu. Dept. of Microbiology.
Leslie R. Berger, Leslie Q. Tam, and Danny H. Pope.
Available from NTIS as AD-70 4496, $3.00 in paper copy, $0.95 in microfiche. First Annual Progress Report, April 1, 1970. 15 p.
Identifiers: *Photosynthesis, *Hydrostatic pressure, *Marine biology, Photosynthesis, Algae, Growth, Oxygen, Instrumentation, Experimental design.

Photosynthesis, measured as light-dependent evolution of oxygen was demonstrated in both green and blue-green algae species at hydrostatic pressures exceeding 600 atmospheres. The methodology which made these observations possible is described. A technique to grow obligately aerobic organisms at increased pressures to high population densities is also described.
W71-00449

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
For primary bibliographic entry see Field 05C.
W71-00475

2J. Erosion and Sedimentation

SEDIMENT SAMPLING EFFICIENCY OF SLOTS,
Iowa Univ., Iowa City; and Technion - Israel Inst. of Technology, Haifa.
Michael Poreh, Abraham Sagiv, and Ido Seginer.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7637, p 2065-2078, October 1970. 14 p, 14 fig, 4 ref.

Descriptors: *Sampling, *Bed load, *Sediment load, Sediment transport, Particle size, Open channel flow, Alluvial channels, Instrumentation, Hydraulic models.
Identifiers: Bed-load samplers, Slots.

The sediment sampling efficiency of two-dimensional slots in open channel was studied. Eight fractions of sand and gravel were used ranging in size from 0.2 mm to 4.5 mm. A universal relation between the efficiency, the Froude number and the particle size was established for what is termed the bed load transport range. It was found that the sampling efficiency in this range decreases slightly with particle size and approaches one for large slots openings. The sampling efficiency of smaller particles, which do not move as bed load, was found to increase with particle size but remained smaller than one even for extremely large slot size to particle size ratios. (Knapp-USGS)
W71-00016

SEDIMENT-PICKUP FUNCTION,
Department of Energy, Mines, and Resources, Burlington (Ontario). Canada Centre for Inland Waters; Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering; and Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
Albert R. LeFeuvre, Hilmi D. Altinbilek, and Marion R. Carstens.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7636, p 2051-2063, October 1970. 13 p, 7 fig, 2 tab, 6 ref, append.

Descriptors: *Stream erosion, *Bed load, *Sediment transport, Fluid friction, Density, Velocity, Scour, Deposition (Sediments), Dunes, Channel morphology, Sedimentary structures, Hydraulic models.
Identifiers: Drag, Lift.

A function expressing the rate of removal of bed is presented in terms of the following variables: Local velocity; coefficient of drag; particle diameter; bed slope; angle of repose; and fluid density in the vicinity of the particle. The variables of the function are established by consideration of the forces acting on a typical surface particle. The functional relationship was established by the results of an experimental study. The sediment-pickup function is formulated as a local rate of bed removal in order to be able to incorporate the function in the differential form of the equation of continuity. (Knapp-USGS)
W71-00017

EXPERIMENTAL INVESTIGATION OF FORM OF BED-ROUGHNESS,
Southeastern Massachusetts Univ., North Dartmouth, Dept. of Civil Engineering.
Sat Dev Khanna.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7623, p 2029-2040, October 1970. 12 p, 12 fig, 7 ref, append.

Descriptors: *Channel morphology, *Roughness (Hydraulic), *Open channel flow, *Bed load, *Sediment transport, Dunes, Ripple marks, Turbulent flow, Turbulence, Pressure, Waves (Water), Friction, Fluid friction, Hydraulic models.
Identifiers: Drag, Form drag.

Experimental observations regarding mean velocity distribution, angle of flow, static pressure distribution and longitudinal turbulence intensity are all made along a typical wooden wave in the domain of ripples and dunes of river flow. The wave was produced in a low-turbulence wind tunnel and the measurements were made by hot-wire anemometry in an air medium. From these observations skin friction coefficient, form drag, and other boundary layer parameters have been evaluated to help analyze the process of sediment transport. (Knapp-USGS)
W71-00018

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,
Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W71-00020

SEDIMENT-SEAWATER INTERACTION IN GLACIOMARINE SEDIEMENTS OF SOUTHEAST ALASKA,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W71-00027

OSCILLATION RIPPLEMARKS AND ORBITAL DIAMETER,
Esso Production Research Co., Houston, Tex.
R. A. Baker.
Geological Society of America Bulletin, Vol 81, No 5, p 1589-1590, May 1970. 2 p, 4 ref.

Descriptors: *Ripple marks, *Sedimentary structures, Waves (Water), Equations, Statistics, Sedimentation, Beaches, Sands.
Identifiers: Wave orbital diameter.

Ripplemark wavelength, is related to median sediment diameter and orbital diameter of waves at the sea floor by an empirical equation which indicates an inverse relationship between ripplemark wavelength and orbital diameter, a result contrary to expectation. Away from the shoreline, ripplemarks are far apart and translatory motion is small, while ripplemarks near the shorline are closely spaced and translatory motion is large. (Knapp-USGS)
W71-00035

A STUDY OF STREAM BEHAVIOR IN THE CANTERBURY FOOTHILLS, NEW ZEALAND,
New Zealand Forest Service, Wellington. Forest Service Inst.
For primary bibliographic entry see Field 02E.
W71-00042

SEDIMENT YIELDS OF WISCONSIN STREAMS,
Geological Survey, Washington, D.C.
S. M. Hindall, and R. F. Flint.
For sale by US Geological Survey, Washington, DC 20242 - Price $0.75. Geological Survey Hydrologic Investigations Atlas HA-376, 1 sheet, 1970. Text, 1 fig, 4 map, 1 tab, 15 ref.

Descriptors: *Sediment yield, *Wisconsin, *Sediment load, Provenance, Glacial drift, Loess, Erosion, Maps, Survey, Data collections, Sampling, Gaging stations.
Identifiers: Sediment yield map.

The purpose of this 1-sheet hydrological atlas is to describe the magnitude and variability of sediment in Wisconsin streams, to relate sediment yields to the local environment, and to identify areas that need further study. The report is based on sediment data from 44 stream-gaging sites throughout the State. The average concentration of sediment for the 44 sampled sites throughout the State is 157 mg/liter. Annual basin yields range from 5 to 700 tons per square mile and from 0.5 to 230 acre-feet of sediment volume. Soil types, parent glacial deposits, land use and cover, and topography greatly influence sediment yields. Lowest yields generally come from forested, sandy areas with low topographic relief. The highest yields are from land that is intensely farmed, hilly, and partly covered by loose wind-blown silt. Intermediate yields are from areas of intense agricultural development, where tilled soils are exposed to erosion during a large part of each year. The sediment yield map, prepared from calculated long-term yields and by inference from knowledge of land use, soils, and glacial geology, shows in most areas of the State. (Knapp-USGS)
W71-00050

CARBON-14 CONTENT AND ORIGIN OF CALICHE,
Arizona Univ., Tucson. Dept. of Geology.
Joel J. Sigalove.
MS Thesis, Arizona University Graduate College, 1968. 64 p, 10 fig, 4 tab, 45 ref.

Descriptors: *Caliche, *Deposition (Sediments), Radioactive dating, Hardpan, Calcium carbonate, Leaching, Chemical precipitation, Evaporation, Limestones, Soil chemistry, Water chemistry, Soil water movement, Groundwater movement, Arizona.
Identifiers: San Francisco Volcanic Field (Ariz).

Caliche on various surfaces of known relative age was studied in the San Francisco Volcanic Field near Flagstaff, Arizona. Laboratory studies included carbon-14 analyses of the samples from vertical sections in the southern part of the state. Some caliche is deposited by the evaporation of water in the crevices and on the bottom surface of calcium-rich rocks lying upon the land surface. Most caliche is deposited by the evaporation of water infiltrating through the unsaturated zone. Carbon-14 activity decreases with depth in any given vertical section. In the San Francisco Field, the carbon-14 concentrations of caliche deposits on the younger volcanic surfaces were higher than those found for the

thicker deposits on the older surfaces. Caliche appears to be presently forming at an appreciable rate on surfaces within the San Francisco Volcanic Field. (Knapp-USGS)
W71-00063

A METHOD OF COMPUTING SOIL MOVEMENT THROUGHOUT A FIELD,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.; and Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
C. A. Onstad, C. L. Larson, L. F. Hermsmeier, and R. A. Young.
American Society of Agricultural Engineers Transactions, Vol 10, No 6, p 742-745, 1967. 4 p, 7 fig, 2 tab, 4 ref.

Descriptors: *Soil erosion, *Forecasting, Equations, Runoff, Profiles, Topography, Soil conservation, Model studies, Slopes, Terracing.
Identifiers: Soil erosion forecasting.

An erosion model was designed to provide a basis for computing soil losses with consideration of local variations in slope steepness. The model is useful in obtaining a distribution of net soil loss throughout a topographic profile of any type. A profile classification and terminology are proposed. For curved profiles, the model represents some improvement over an estimate based on mean slope steepness. The model is applicable primarily to the case of two-dimensional erosion, that is, where runoff and erosion occur along parallel lines. Modification would permit consideration of the general case of three-dimensional erosion, where erosion takes place along nonparallel lines. (Knapp-USGS)
W71-00069

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 (MOLE) NaCl SYSTEM,
Wisconsin Univ., Madison. Dept. of Soil Science.
J. D. H. Williams, J. K. Syers, R. F. Harris, and D. E. Armstrong.
Environmental Science and Technology, Vol 4, No 6, p 517-519, 1970. 2 tab, 11 ref. OWRR Project B-022-WISC.

Descriptors: *Adsorption, *Inorganic compounds, *Phosphorus, *Sediments, *Lakes, Sodium chloride, Calcium compounds, Sampling, Wisconsin, Productivity, Oxygen, Hypolimnion, Thermal stratification, Eutrophication, Oligotrophic, Retention.
Identifiers: *Desorption, Lake Mendota (Wis), Wisconsin lakes, Calcareous lake sediments, Noncalcareous lake sediments, Adsorption-desorption.

Results of investigations of adsorption and desorption of inorganic phosphorus in a 0.1 mole sodium chloride system by lake sediments of contrasting chemical composition are described. Sediments were sampled from Wisconsin lakes. Noncalcareous sediments generally adsorbed and retained more added inorganic phosphorus than calcareous lake sediments. Sediments retaining the most added phosphorus during adsorption tended to release the least phosphorus during a subsequent desorption at all levels of added phosphorus. Net amount of added phosphorus adsorbed (following adsorption and desorption) was lowest for calcareous sediments--with one exception--at the highest level of added phosphorus (50 micrograms of phosphorus/milliliter). Reactions involved in adsorption and desorption of added phosphorus were not always completely reversible during the experimental period. A close relationship was found between the order of sediment capacity to retain added phosphorus in the laboratory and the levels of native total phosphorus and inorganic phosphorus in the sediment. No consistent relationship appears to exist between lake eutrophication and phosphorus retention capacity; apparently, the state of lake eutrophication cannot be explained solely on the basis of capacity of sediments to retain phosphorus. (Jones-Wisconsin)
W71-00115

CHANNEL-SCARP FORMATION IN WESTERN NORTH DAKOTA,
Geological Survey, Grand Forks, N. Dak.
For primary bibliographic entry see Field 04D.
W71-00185

A METHOD OF ESTIMATING ANNUAL SUSPENDED-SEDIMENT DISCHARGE,
Geological Survey, Tacoma, Wash.
Leonard M. Nelson.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C233-C236, 1970. 4 p, 5 fig, 1 tab, 1 ref.

Descriptors: *Sediment load, *Suspended load, *Sediment transport, *Discharge (Water), *Sediment discharge, Peak discharge, Streamflow, Sediment yield, Washington, Hydrogeology, Gaging stations, Sampling, Statistical methods, Data collections, Hydrologic data.
Identifiers: Streamflow-sediment discharge relations.

A simple method is proposed for estimating annual suspended-sediment discharge during years for which stream-flow records are available but for which sediment records are not available. Readily accessible information on the parameters of annual peak and annual mean water discharges is used with the available sediment records to estimate the average annual suspended-sediment discharge. The relation between the two parameters and the annual suspended-sediment discharge is well defined for many streams. This relation does not fit all streams, however, and a thorough understanding of a basin's geologic and hydrologic characteristics is needed for application of the method proposed. (Knapp-USGS)
W71-00186

GEOLOGY, MINERAL DEPOSITS, AND GEOCHEMICAL AND RADIOMETRIC ANOMALIES, SERPENTINE HOT SPRINGS AREA, SEWARD PENINSULA, ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-00203

GLACIAL EROSION, ICE RAFTING, AND GLACIAL-MARINE SEDIMENTS: ANTARCTICA AND THE SOUTHERN OCEAN,
Florida State Univ., Tallahassee. Dept. of Oceanography.
Detlef A. Warnke.
Amerian Journal of Science, Vol 269, No 3, p 276-294, October 1970. 19 p, 2 fig, 2 tab, 79 ref. NSF Grants GA-264, GA-657, and GA-1320.

Descriptors: *Glaciers, *Erosion, *Sediment transport, *Glacial drift, *Antarctic, Regimen, Icebergs, Rheology, Scour, Sedimentation, Sedimentation rates, Sediment load.
Identifiers: Antarctica, Glacial erosion efficiency.

The Antarctic continent is surrounded by glacial-marine sediments deposited by melting icebergs. Modern Antarctic glaciers and icebergs, however, carry no or very little debris. This points to a period of heightened erosional efficiency at some stage in the early development of Antarctic glaciation. The results of field studies in the ice-free areas of the continent, as reported in the literature, seem to confirm this view. The period of maximum efficiency was gradually phased out when easily erodible, weathered material was no longer available, or when the ice-substrate boundary conditions changed over significant portions of the continent, or when some form of geomorphic equilibrium was attained. These various explanations are not mutually exclusive; they are in part interrelated. The overall decrease in erosional efficiency of Antarctic glaciers is reflected in available deep-sea core descriptions. Additional studies aimed to confirm, modify, or reject this view and to define the newly demonstrated ice-sheet fluctuations offer promising avenues for further sediment-petrographic investigations of Antarctic core material. (Knapp-USGS)
W71-00346

MODEL SIMILARITY CONCERNING THE TRANSPORT OF SUSPENDED MATTER IN A TURBULENT FLOW FIELD,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-00358

DIMENSIONAL ANALYSIS OF ALLUVIAL CHANNELS WITH SPECIAL REFERENCE TO MEANDER LENGTH,
Hydraulics Research Station, Wallingford (England).
Peter Ackers, and F. G. Charlton.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 287-316, 1970. 30 p, 4 fig, 1 tab, 26 ref.

Descriptors: *Alluvial channels, *Meanders, *Channel morphology, *Discharge (Water), *Sediment load, Sediment transport, Sands, Open channel flow, Data collections, Particle size, Hydraulic models, Dimensional analysis.
Identifiers: Meander length.

Discharge, sediment load, hydraulic gradient and channel geometry were measured in channels in an area of fine sand which achieved a meander pattern through natural processes, at discharges between 0.006 and 0.09 cu m/sec. Channels with small sediment loads remained straight and meandering occurred naturally at higher sediment loads. Dimensionless parameters were derived which provide a good framework for the analysis of stream geometry. No simple relation between meander length and discharge is completely satisfactory and none of the many empirical relations between meander length and discharge appears to have special physical significance. (Knapp-USGS)
W71-00361

SOME GEOLOGICAL CHARACTERISTICS OF SEDIMENTS FROM THE NORTH ATLANTIC OCEAN,
Utrecht Rijksuniversiteit (Netherlands). Vening Meinesz Lab. for Geophysics and Geochemistry.
C. H. Van der Weijden, R. D. Schuiling, and H. A. Das.
Marine Geology, Vol 9, No 2, p 81-99, September 1970. 19 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Bottom sediments, *Water chemistry, *Geochemistry, *Atlantic Ocean, Clay minerals, Oceans, Mineralogy, Sampling, Ion exchange, Salts, Saline water systems, Clays, Analytical techniques, Chemical analysis.
Identifiers: Sedimentary geochemistry.

Eh- and pH-measurements were made in a number of North Atlantic deep-sea sediments. Ten cores with marked changes in redox potential were analyzed for Si, Al, Na, K, Cl, Fe, Mn, Co, Sc, Cu, and carbonate. A significant correlation was found between Eh and Mn-content. Fe, Co, and Sc are correlated with the illitic clay-content, while no relation was found between Cu and any other main constituent. The examined sediments chiefly consist of calcium carbonate, quartz, feldspars, and illitic clays. (Knapp-USGS)
W71-00362

FORMATION OF THE BARRIER SPIT AND OTHER SAND RIDGES NEAR CHILKA LAKE ON THE EAST COAST OF INDIA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Venkatarathnam.
Marine Geology, Vol 9, No 2, p 101-116, September 1970. 16 p, 6 fig, 2 tab, 20 ref. USGS Contract 14-08-0001-10924.

Descriptors: *Sedimentation, *Sedimentary structures, *Sand bars, *Sand spits, Coasts, Currents (Water), Sediment transport, Geomorphology, Waves (Water), Lagoons, Provenance.
Identifiers: Spits, India, Chilka Lake (India).

Chilka Lake is a lagoon on the east coast of India. It is separated from the Bay of Bengal by a barrier spit attached at the southern end. Landward of the spit, but adjacent to it, are a number of other sand ridges, some of which are parallel to the coast. The morphology and composition of the sediments forming the spit and other ridges, the bathymetry of the continental shelf off Chilka Lake, the waves and wave refraction, and the tidal and river currents in the region are described. Considerable quantities of sand for the building of the spit and the other ridges were derived from the adjacent seabed and/or from the land south of Chilka Lake. The processes of deposition of the spit and the ridges were initiated sometime during the last sea-level rise, before 3,750 years B.P. Constructive wave action and northward drift were the main processes in the building of the spit from the southern part where there is an abrupt curvature in the solid coastline. The changes in the orientation of the spit are due, in particular, to the differences in the shelf gradients off the coast, the absence or presence of strong river and tidal currents, and the pattern of wave refraction. (Knapp-USGS)
W71-00365

MAGNETIC PROPERTIES OF SOME CANYON SEDIMENTS,
Southampton Univ. (England).
A. I. Rees.
Marine Geology, Vol 9, No 2, p M12-M16, September 1970. 5 p, 4 fig, 5 ref. NSF Grant GP 111.

Descriptors: *Sedimentary structures, *Sands, *Magnetic studies, Oceanography, Ocean currents, Marine geology, Tides, Topography, Coasts, Deposition (Sediments), Sedimentation.
Identifiers: Magnetic fabric (Sediments), Baja (Cal).

The magnetic fabrics of two box samples from the Santa Maria Canyon, Baja, California, are primary in style although one is extensively burrowed. The fabrics are caused at least in part by depositional dips. (Knapp-USGS)
W71-00366

MAGNETIC FABRIC OF SEDIMENTS FROM THE SHELF AT LA JOLLA (CALIFORNIA),
Southampton Univ. (England).
N. Hamilton, and A. I. Rees.
Marine Geology, Vol 9, No 2, p M6-M11, September 1970. 6 p, 3 fig, 3 tab, 10 ref. ONR Contract 2216 (05), NSF Grant GP 3373.

Descriptors: *Sedimentary structures, *Sands, *Magnetic studies, Oceanography, Ocean currents, Marine geology, Tides, Topography, Coasts, Deposition (Sediments), Sedimentation.
Identifiers: Magnetic fabric (Sediments), La Jolla (Calif).

The magnetic fabrics of seven oriented box cores taken in water depths less than 100 m near La Jolla, California are described. All are fine sands and except a relict beach sediment, all appear to have been in sedimentary equilibrium with present conditions. They show signs of burrowing. The present magnetic fabric of all samples show signs of distrubance. Four of the seven retain sufficient primary fabric for a current direction to be estimated. There is evidence that the fabric disturbance is a result of the organic activity. (Knapp-USGS)
W71-00367

EVIDENCE OF SEDIMENTATION BY GRAVITY-ASSISTED BOTTOM CURRENTS IN THE MEDITERRANEAN SEA,
Florence Univ. (Italy). Inst. of Geology; and SACLANT ASW Research Centre, La Spezia (Italy).
C. Bartolini, and G. E. Gehin.
Marine Geology, Vol 9, No 2, p M1-M5, September 1970. 5 p, 3 fig, 5 ref.

Descriptors: *Sedimentation rates, *Oceans, *Turbidity currents, Deposition (Sediments), Sediment distribution, Sediment transport, Bottom sediments, Sampling, Oceanography, Stratification.
Identifiers: Mediterranean Sea.

Differences in the sedimentation rates of hemipelagic muds in the western Mediterranean were estimated by sampling. Within a water depth difference of 9 m, corresponding to a distance on the sea bottom of only 5 nautical miles, the sedimentation rate doubles from about 20 cm/1,000 year towards the basin rims, to 40 cm/1,000 year in the topographic lows of the basin center. The 'rain of sediment' process is ruled out as the principal deposition agent. The turbidity-current and normal-current hypotheses are briefly discussed as the most realistic alternatives. The lateral variations of the sedimentation rates are rather constant during the investigated time span, approaching 15,000 years. (Knapp-USGS)
W71-00368

BEACH CHANGES BY EXTRAORDINARY WAVES CAUSED BY HURRICANE CAMILLE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Choule J. Sonu.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 35-45, Technical Report 77, February 1970. 11 p, 5 fig, 1 tab, 9 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Beach erosion, *Hurricanes, *Erosion, *Florida, Surges, Waves (Water), Currents (Water), Water levels, Storms, Damages, Floods, Geomorphology, Topography, Sands.
Identifiers: Ft. Walton (Fla), Hurricane Camille (1969).

Drastic erosion and swift recovery were the major characteristics of beach changes associated with Hurricane Camille at Fort Walton, Florida. Storm waves caused general erosion of the beach surface, and a scarp about 1 meter deep was produced about 40 meters behind the shoreline. After the hurricane, humps of sand in a train with regular spacing along the shore emerged in the surf zone bed. These were formed by longshore currents, which probably acted on large quantities of sand brought into the surf zone bed as a result of the preceding subaerial erosion. The humps subsequently moved shoreward and eventually climbed on the beach; a substantial part of the exposed beach volume was thus restored about a week after the hurricane. (Knapp-USGS)
W71-00380

EFFECTS OF HURRICANE CAMILLE ON THE LANDSCAPE OF THE BRETON-CHANDELEUR ISLAND CHAIN AND THE EASTERN PORTION OF THE LOWER MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright, F. J. Swaye, and J. M. Coleman.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 13-34, Technical Report 76, February 1970. 22 p, 17 fig, 16 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Hurricanes, *Erosion, *Beach erosion, *Louisiana, *Surges, Waves (Water), Currents (Water), Water levels, Storms, Damages, Floods, Geomorphology, Vegetation effects.
Identifiers: Hurricane Camille (1969).

Air and ground reconnaissance immediately following the passage of Hurricane Camille disclosed significant modifications to the natural landscape of the Breton-Chandeleur Island arc and to the eastern portion of the lower Mississippi Delta. Considerable dissection and redeposition was evident along beach and barrier formations, and total obliteration dominated numerous sections. Trends of redistributed beach material strongly reflected the final direction of hurricane-induced mass transport of water. In the lower delta damage was mainly to marsh vegetation and was attributable to high water and surge currents directed almost entirely from north to south. (Knapp-USGS)
W71-00381

PATTERN FORMING FORCES IN DELTAS,
Asian Inst. of Tech., Bangkok (Thailand).
Catalino del Rosario dela Cruz.
M.Eng. Thesis No 275, Asian Institute of Technology, 1970. 80 p, 48 fig, 5 tab, 60 ref, 3 append.

Descriptors: *Deltas, *Geomorphology, *Sedimentation, Sediment transport, Sediment yield, Provenance, Ocean water, Ocean waves, Waves (Water), Currents (Water), Streamflow, Salinity, Rainfall, Runoff, Statistical methods, Regression analysis, Data collections.
Identifiers: Delta formation.

Patterns and the causative independent variables of delta formation include river, ocean, and climatic forces. The river variables include mean annual discharge, sediment yield and river slope to the sea. Ocean variables consist of continental shelf characteristics, including width, depth of edge, bed slope, sea and swell waves duration, swell direction, and salinity. Climatic elements are temperature and rainfall. Regression analysis was used in obtaining predictive equations for discharge and sediment yield as a function of catchment characteristics. From the chosen variables, the following showed best correlation: mean annual rainfall and area for the discharge; and percentage of mountainous area, relief, area, and perimeter for the sediment yield. A similar regression analysis was applied to determine the relative influence of delta producing variables. Among the selected delta features, the following gave good correlations with the independent variables: apex-to-sea length, area, maximum width, maximum width to number of mouth ratio, ratio of maximum width to total number of distributaries, topography and side topography. (Knapp-USGS)
W71-00384

PORE FLUIDS OF RECENT MARINE SEDIMENTS: 1. OXIDIZING SEDIMENTS OF 20 DEGREES N, CONTINENTAL RISE TO MID-ATLANTIC RIDGE,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02K.
W71-00386

SOURCE AND DISPERSION OF SURFACE SEDIMENTS IN THE GULF OF MAINE--GEORGES BANK AREA,
Woods Hole Oceanographic Institution, Mass.
David A. Ross.
Supported by US Geological Survey, Washington, D.C. Journal of Sedimentary Petrology, Vol 40, No 3, p 906-920, September 1970. 15 p, 7 fig, 4 tab, 25 ref.

Descriptors: *Sedimentation, *Maine, *Continental shelf, *Bottom sediments, *Provenance, Sediment transport, Erosion, Glacial drift, Mineralogy, Sands, Tracking techniques, Sampling, Dispersion.
Identifiers: Gulf of Maine, Georges Bank.

A study of mineral composition of the sand fraction (2 to 0.062 mm) of 115 surface samples from the Gulf of Maine--Georges Bank area defined eight provinces based on heavy mineral composition. Sediments in three provinces, off the Penobscot, Kennebec, and Merrimack Rivers, are of recent origin. The remaining five provinces are composed of relict sediments of which three are of glacial origin. Sediments of Georges Bank are reworked from the Coastal Plain. Fine-grained sediments were winnowed from Georges Bank and transported into the Gulf of Maine where they are mixed with glacial sediments. Mineral composition

throughout the area of study is controlled mainly by the source. This modification is most pronounced in the high energy areas of Georges Bank and off Cape Cod, where more resistant heavy minerals predominate. The sediments in these areas are also better sorted and have lower feldspar--quartz ratios than the sediments in the low energy areas of the Gulf of Maine. (Knapp-USGS)
W71-00387

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-00388

REPEATABILITY OF THREE INSTRUMENTS USED TO DETERMINE THE UNDRAINED SHEAR STRENGTH OF EXTREMELY WEAK, SATURATED, COHESIVE SEDIMENTS,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-00389

TURBID BOTTOM WATER ON THE CONTINENTAL SHELF OF THE NORTHERN BERING SEA,
Washington Univ., Seattle. Dept. of Oceanography.
Dean A. McManus, and C. Stephen Smyth.
Journal of Sedimentary Petrology, Vol 40, No 3, p 869-873, September 1970. 5 p, 3 fig, 9 ref. USGS Contract No 14-08-0001-10924.

Descriptors: *Sediment transport, *Continental shelf, *Alaska, Silts, Currents (Water), Turbidity, Mineralogy, Pertide size, Sampling, Sedimentation, Suspended load, Bed load, Bottom sediments.
Identifiers: *Bering Sea.

In July 1968, the bottom water on the continental shelf of the northern Bering Sea contained concentrations of suspended material in excess of 2 ppm. Near the Alaska mainland, concentrations were as much as fivefold greater. The material is 85 percent mineral grains and has a modal particle size of 20 microns. Because of the net northward movement of the water through Bering Strait into the Chukchi Sea, the bottom water with its high silt concentration appears to be an important transport mechanism for supplying modern silt to the shelf in the Chukchi Sea. (Knapp-USGS)
W71-00390

THE LATERIAL DISTRIBUTION OF CLAY MINERALS IN LAKES PONTCHARTRAIN AND MAUREPAS, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
Robert A. Brooks, and Ray E. Ferrell, Jr.
Journal of Sedimentary Petrology, Vol 40, No 3, p 855-863, September 1970. 9 p, 10 fig, 2 tab, 18 ref. OWRR Project A-007-LA.

Descriptors: *Clay minerals, *Clays, *Brackish water, *Water chemistry, *Sedimentation, Louisiana, Lakes, Deposition (Sediments), Flocculation, Kaolinite, Montmorillonite, Illite, Salinity, Saline water systems.
Identifiers: Lake Pontchartrain (La), Lake Maurepas (La).

Lakes Pontchartrain and Maurepas, Louisiana, are large bodies of brackish water. Water chemistry influences the lateral distribution of clay minerals. The water level in the lake system fluctuates rapidly, and as a result, the salinity of any given area is quite variable over a given period of time. However, the trends of the ionic gradients are fairly constant. Clay minerals flocculate and settle in consistent patterns in response to these compositional gradients. Kaolinite flocculates and settles in areas of lowest salinity. Montmorillonite has its greatest concentration in the higher salinity portions of the lake and is the most resistant to settling. Illite also appears to be concentrated in the sediments of the higher salinity areas. The K:H and Na:H ratios in the more saline portions of the lake approach the ratios, which define the hydrochemical stability field of K-mica, and suggest that Illite may be formed as an alteration product of other clay material. (Knapp-USGS)
W71-00391

SEDIMENT PROBLEMS IN URBAN AREAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04C.
W71-00393

THE RELATIONSHIP BETWEEN WATERSHED GEOLOGY AND BEACH RADIOACTIVITY,
California Univ., Berkeley. Hydraulic Engineering Lab.
John R. Byerly.
Available from NTIS as AD-420425, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 135, August 1963. 32 p.
Identifiers: Hydrology, California, *Beaches, Radioactivity, *Gamma ray spectroscopy, Analysis, Minerals, Geochemistry, Igneous rock, Radiochemistry, Decay schemes, Thorium, Uranium, Decay schemes, Sedimentary rock, Watersheds, Santa Cruz (California).

A correlation between the watershed geology of the Ben Lomend Mountain area north of Santa Cruz, California, and the radioactivity of the beaches receiving sediment from the watershed has been attempted. The radioactivity of stream and littoral sediments have been presented in terms of concentration of thorium as determined by gamma-ray spectroscopy. The results have not shed any light on the watershed geology-beach radioactivity relationship as the area of study failed to produce a radiometric anomaly of sufficient magnitude to be reflected in the littoral sediment. The resluts do show considerable variation in the thorium content of the stream sediment but the variation is not consistent with any known geological variation.
W71-00453

SPECIFIC GRAVITY DETERMINATION OF MARINE SEDIMENTS,
Naval Postgraduate School, Monterey, Calif.
Joseph C. Henderson.
Available from NTIS as AD-706 731, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, April 1970. 124 p.
Identifiers: *Ocean bottom, Density, *Specific gravity, Densimeters, Kaolinite, Montmorillonite, Colloids, Test methods, Quartz, Theses, Naval research.

Accurate specific gravity measurements are required for the analysis of physical properties of marine sediments. Application of the bottle pycnometer technique, the standard determination method, is time-consuming, tedious, and perhaps subject to inaccuracies in the case of fine particulate matter. A review of methods currently in use was conducted to ascertain the present state of the art and reveal any new developments in this field. Specific gravity values for three operating modes of the air comparison pycnometer, two of which use helium, were compared with bottle pycnometer values for four test materials. The air comparison pycnometer determinations, regardless of operating mode, resulted in higher specific gravities than their counterpart bottle pycnometer values for kaolinite, montmorillonite, and marine sediment samples. The use of helium as the comparison medium in the air comparison pycnometer appears to reduce the surface active characteristics of the colloidal material. Specific gravity determinations by all four test methods agreed very well for powdered quartz samples with a known specific gravity.
W71-00461

2K. Chemical Processes

A STUDY OF GROUNDWATER POLLUTION BY SALT.
For primary bibliographic entry see Field 05B.
W71-00001

SEA WATER,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 01B.
W71-00008

SEDIMENT-SEAWATER INTERACTION IN GLACIOMARINE SEDIEMENTS OF SOUTHEAST ALASKA,
Alaska Univ., College. Inst. of Marine Science.
Ghanshyam D. Sharma.
Geological Society of America Bulletin, Vol 81, No 4, p 1097-1105, April 1970. 9 p, 14 fig, 1 tab, 15 ref. AEC Grant No AT (04-3)-310; NSF Grant No GP 5115.

Descriptors: *Water chemistry, *Connate water, *Sediments, *Alaska, *Glacial drift, Sea water, Clay minerals, Chemical reactions, Geochemistry, Saline water systems, Ion exchange, Ion transport, Glaciers.
Identifiers: Glaciomarine sediments.

The chemical composition of interstitial waters and the mineralogy of recent glaciomarine sediments from southeast Alaska were determined to study the interaction between sediments and sea water. Differences in chemical composition of overlying and interstial waters of bottom sediments reflected the nature and extent of sediment-sea water interaction. Such interaction depends on bulk mineralogy and particle size of sediments, evironment of deposition, and path length the sediments follow prior to deposition. During transport and early stages of burial, cation exchange is the major process responsible for changes in the composition of interstitial water and sediments. Analyses of interstitial waters of cores indicated maximum variations with depth in sodium ion concentration, followed by calcium and magnesium ion concentrations. (Knapp-USGS)
W71-00027

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 01B.
W71-00040

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03A.
W71-00064

EVIDENCE OF DIURNAL MINERAL VARIATIONS OF CERTAIN CHEMICAL FACTORS IN MOUNTAIN STREAMS AS INFLUENCED BY BENTHIC ORGANISMS (IN FRENCH),
Bernard Serra-Tosio.
Comptes Rendus Academie des Sciences, Paris, Vol 269, No 24, Serie D, p 2431-2434, 1969. 2 fig, 3 ref.

Descriptors: *Chemical properties, *Diurnal distribution, *Fluctuations, *Streams, Sampling, Phytoplankton, Aquatic organisms, Diatoms, Absorption, Biochemistry, Metabolism, Volumetric analysis.
Identifiers: *Mountain streams, Water chemical variations, Furon River (France), Bourne River (France), Hydrotitrometric degree.

Determination of total oxygen, pH, and contents of oxygen, silica, nitrates, phosphates, Sulfates, Total

alkalinity, and titration value in water of two mountain streams were performed at 4-hour intervals during June, July, and September. With the exception of sulfates, the results showed a diurnal variation of analysed factors, correlated with the time of water sampling and activity of phytobenthic and phytoplanktonic organisms. The supply of oxygen and most of mineral nutrients was depleted during the daytime hours, whereas the supply of phosphates was depleted during the nights. (Wilde-Wisconsin)
W71-00097

INFLUENCE OF ARSENIC OXIDE IONS ON THE ABSORPTION OF PHOSPHATE IONS BY CHLORELLA (IN FRENCH),
Centre Universitaire de Luminy, Marseille (France).
Robert Jeanjean, and Francis Blasco.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 15, Serie D, p 1897-1900, 1970. 5 fig, 9 ref.

Descriptors: *Algae, *Chlorella, *Absorption, *Phosphate, Inhibition, Kinetics, Phosphorus radioisotopes, Analytical techniques, Arsenic compounds.
Identifiers: *Arsenic oxide, Geiger counter, Michaelis-Menten method, Liquid scintillation.

The effect of arsenic oxide on absorption of labeled phosphorus by Chlorella was determined by measuring the radioactivity of cultured algae with a Geiger counter, or by liquid scintillation. The results showed that arsenic oxide, structurally analogous to phosphate, acts as a competitive inhibitor in the absorption of phosphorus, the inhibition being in principle a reversible process. The rate of absorption is a function of time and the concentration of both antagonists. (Wilde-Wisconsin)
W71-00102

PHYTOPLANKTON, PHOTOSYNTHESIS, AND PHOSPHORUS IN LAKE MINNETONKA, MINNESOTA,
Minnesota Univ., Minneapolis. Limnological Research Center.
Robert O. Megard.
Minnesota State Pollution Control Agency PRO-912-MNN. Contribution no 90, Limnological Research Center, 1970. 45 p, 20 fig, 10 tab, 30 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Phosphorus, *Minnesota, Light intensity, Seasonal, Algae, Nitrogen fixation, Chlorophyll, Mathematical models, Primary productivity, Temperature, Depth, Eutrophication, Nitrogen, Sewage effluents, Oxygen, Water chemistry, Alkalinity, Hydrogen ion concentration, Sediments, Density, Cyanophyta, Chrysophyta, Chlorophyta, Pyrrophyta, Euglenophyta, Remote sensing, Minnesota.
Identifiers: *Lake Minnetonka (Minn), Asterionella, Anabaena, Morphometry, Cryptophyta, Peridiniales, Cryptomonadales, Desmidiales, Chlorococcales, Volvocales, Pennales, Centrales, Chroococcales, Hormogonales.

The relationships among phytoplankton population densities, light attenuation, and integral photosynthesis are used as basis for a model of the planktonic photosynthetic system. Total photosynthesis beneath a unit of water surface (integral photosynthesis) is estimated from the phytoplankton density and the photosynthetic rate at optimal illumination. Analysis of the phosphorus budget indicates that phosphorus is deposited in sediments soon after it enters the lake (Minnetonka). Net rate of phosphorus deposition is similar to rate of influx from the watershed. There is no relationship between phosphorus and photosynthesis during spring and autumn, when phosphorus concentrations are highest, but photosynthesis is closely related to concentrations of total phosphorus during summer when the dominant algae are species able to fix nitrogen. Phytoplankton never fully utilize phosphorus concentrations exceeding 100 milligrams/cubic meter, because population density and resultant shading, limits integral photosynthesis. Nuisance algal blooms can be quickly reduced by controlling phosphorus influx. The model suggests that integral photosynthesis increases linearly as chlorophyll concentrations increase to 16 milligrams/cubic meter and provides a basis for estimating primary productivity of large water bodies from remotely sensed chlorophyll concentrations and temperature measurements. (Jones-Wisconsin)
W71-00108

CONDENSED PHOSPHATES IN LAKE WATER AND WASTE WATER,
Toronto Univ. (Ontario). Dept. of Civil Engineering; and McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
G. W. Heinke, and J. D. Norman.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 6 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Phosphates, *Lakes, *Waste water (Pollution), *Hydrolysis, Detergents, Great Lakes, Temperature, Hydrogen ion concentration, Activated sludge, Treatment, Eutrophication, Surfactants, Enzymes, Lake Ontario, Seasonal, Algae, Cultures, Microorganisms, Effluents, Settling basins, Waste water treatment, Laboratory tests.
Identifiers: *Condensed phosphates, Sodium tripolyphosphate, Sodium pyrophosphate.

Hydrolysis rate of sodium tripolyphosphate and sodium pyrophosphate in Great Lakes water and waste water under conditions of temperature, pH and concentration occurring in the environment are evaluated. Condensed phosphates from detergents are major phosphorus contributors to waste water--about double the human waste contribution in the United States and about equal to it in Canada. Condensed phosphates hydrolyze extensively during activated sludge treatment, with about 15% remaining in the effluent, hydrolyzing in waste water three times faster in summer than winter. Once discharged to surface waters, hydrolysis proceeds at a much slower rate, depending on the extent of microbial activity in the surface water. Studies on the effect of pH changes show fastest rates of hydrolysis occurring at the natural pH of waste water or lake water. Experimental data at low levels of concentration, below 15 milligrams/liter phosphates, are best fitted by a zero-order model. A graphical presentation allows an order of magnitude prediction of hydrolysis rate to be expected in a particular situation. Results of this work are of value in research on phosphorus removal methods and eutrophication studies. (Jones-Wisconsin)
W71-00116

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
For primary bibliographic entry see Field 05A.
W71-00142

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY,
Eastman Kodak Co., Rochester, N.Y.
For primary bibliographic entry see Field 05A.
W71-00168

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY - USE OF G.E. GERMICIDAL ULTRAVIOLET INTENSITY METER,
Eastman Kodak Co., Rochester, N.Y.
For primary bibliographic entry see Field 05A.
W71-00169

PHOTOMETRIC MERCURY ANALYSIS - CORRECTION FOR ORGANIC SUBSTANCES,
Eastman Kodak Co., Rochester, N.Y. Research Labs.
For primary bibliographic entry see Field 05A.
W71-00170

SENSITIVE SIMPLE MERCURY PHOTOMETER USING MERCURY RESONANCE LAMP AS A MONOCHROMATIC SOURCE,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
For primary bibliographic entry see Field 05A.
W71-00171

PORTABLE ATOMIC ABSORPTION PHOTOMETER FOR DETERMINING NANOGRAM QUANTITIES OF MERCURY IN THE PRESENCE OF INTERFERING SUBSTANCES,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
For primary bibliographic entry see Field 05A.
W71-00172

NATURAL ORGANIC ACIDS AS AGENTS OF CHEMICAL WEATHERING,
Geological Survey, Denver, Colo.; and Colorado School of Mines, Golden. Dept. of Chemistry.
H. Ling Ong, Vernon E. Swanson, and Ramon E. Bisque.
Chapter C for sale by the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Professional Paper 700-C, p C130 - C137, 1970. 8 p, 6 fig, 1 tab, 40 ref. USGS Grant No. 14-08-001-6-12.

Descriptors: *Weathering, *Humic acids, *Soil formation, Leaching, Mineralogy, Soil chemistry, Water chemistry, Ion transport, Ion exchange.
Identifiers: Chemical weathering.

Naturally occurring organic acids, commonly called 'humic acids,' are effective agents in the colloidal transport of copper, lead, zinc, iron, and alluminum. Concentrations of organic acids in the range of 4-40 ppm carbon in water can effect increases of several orders of magnitude in the amount of these metals 'stabilized' in solution. Stability of these metal-organic colloids increases with increasing organic acid concentration and increasing pH. The optimum condition for the stability, in general, lies between pH 6 and pH 9. Chemical weathering due to differential leaching of cations by organic acids may be largely responsible for the formation of sedimentary aluminum and lateritic deposits, which are restricted to tropical and subtropical regions where organic acids are abundant. (Knapp-USGS)
W71-00174

THE USE OF AUTOMATED TITRIMETRY FOR ANALYSES OF NATURAL WATER,
Geological Survey, Denver, Colo.; and Geological Survey, Oklahoma City, Okla.
Marvin J. Fishman, and Ralph F. Pascoe.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C222-C225, 1970. 4 p, 4 fig, 2 tab, 2 ref.

Descriptors: *Water analysis, *Automation, *Volumetric analysis, Water chemistry, Alkalinity, Chlorides, Sulfates, Analytical techniques, Chemical analysis, Laboratory tests.
Identifiers: Automated titrimetry.

Automated titrimetric analysis was applied to the determination of alkalinity, chloride, and sulfate in fresh water. Replicate analyses and comparison of results with those obtained by similar manual titration methods show that automated titrimetric methods are accurate and reproducible, and pro-

vide a rapid means for the determination of these substances in water. (Knapp-USGS)
W71-00183

AUTOMATED POTENTIOMETRIC DETERMINATION OF CHLORIDE IN WATER,
Geological Survey, Denver, Colo.
Marvin J. Fishman, and Oliver J. Feist, Jr.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C226-C228, 1970. 3 p, 2 fig, 2 tab, 4 ref.

Descriptors: *Water analysis, *Automation, *Volumetric analysis, Chemical analysis, Water chemistry, Chlorides, Analytical techniques, Laboratory tests.
Identifiers: Potentiometric analysis.

Chloride is determined with standard silver nitrate solution by automated potentiometric titration using chloride ion-selective and reference electrodes. Replicate analyses and comparison of results with those obtained by other automated methods show that the automated potentiometric method is as accurate and reproducible as other methods, and provides a rapid means for the determination of chloride in water. (Knapp-USGS)
W71-00184

GEOLOGY, MINERAL DEPOSITS, AND GEOCHEMICAL AND RADIOMETRIC ANOMALIES, SERPENTINE HOT SPRINGS AREA, SEWARD PENINSULA, ALASKA,
Geological Survey, Washington, D.C.
C. L. Sainsbury, Travis Hudson, Reuben Kachadoorian, and Thomas Richards.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. Geological Survey Bulletin 1312-H, 1970. 19 p, 2 fig, 1 plate, 4 tab, 12 ref.

Descriptors: *Geochemistry, *Exploration, *Surveys, *Sampling, Data collections, Trace elements, Investigations, Placer mining, Sediments, Faults (Geology), Mineralogy.
Identifiers: Geochemical prospecting.

Geologic mapping, analyses of samples of bedrock, and geochemical studies have disclosed the probable source of placer gold and tin on Humboldt Creek, Serpentine-Kougarok area, Alaska, and have shown mineralized bedrock in several areas on the east side of the granite stock at Serpentine Hot Springs. Gold, silver, mercury, arsenic, cobalt, copper, molybdenum, nickel, lead, antimony, tin, tungsten, and zinc occur in panned stream concentrates and in altered bedrock that is associated with steep faults, thrust faults, and quartz veins. Two mineralized and altered fault zones were sampled in detail; one contains float fragments of highly argentiferous galena (as much as 5,000 parts per million Ag). Anomalous amounts of metal in bedrock samples, in stream sediments, and in panned concentrates from stream sediments and rock samples suggest areas of mineralized bedrock outside the granite; radiometric anomalies lie within the granite and near the contact of the granite but have not been evaluated on the ground. (Knapp-USGS)
W71-00203

SILICATE MINERAL STABILITY AND MINERAL EQUILIBRIA IN THE GREAT LAKES,
Syracuse Univ., N.Y. Dept. of Geology.
For primary bibliographic entry see Field 02H.
W71-00204

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
For primary bibliographic entry see Field 05D.
W71-00214

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-00355

GEOTHERMAL WASTES AND THE WATER RESOURCES OF THE SALTON SEA AREA,
California State Dept. of Water Resources, Sacramento.
Sanford L. Werner, and Larry J. Olson.
Copies of report may be obtained from Office of Procurement, Documents Section, PO Box 20191, Sacramento, Calif. 95820--Price $3.50. California Department of Water Resources Bulletin No 143-7, February 1970. 123 p, 10 fig, 2 plate, 14 tab, 121 ref, 7 append.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Geothermal studies, Waste storage, Water quality, Chemical analysis, Salinity, Trace elements, Radiochemical analysis, Hydrology, Climatic data, Streamflow, Irrigation, Geology, Recreation facilities.
Identifiers: Lake inflow, Imported water, Mud volcanoes.

Data and information derived from previous studies and from investigations in the field concerning water resources and geothermal wastes of the Salton Sea Area in California are evaluated. To date, the development of the geothermal resources in the Salton Sea Area has been centered in the Buttes thermal area, southeast of the Salton Sea, involving the drilling of 15 geothermal wells. Development of geothermal resources in the Salton Sea Area has been hindered considerably by the lack of available disposal sites for brine, bittern wastes, and accumulated salt deposits. Moreover, the highly saline brine has caused operational problems. Estimated heat content of the Salton Sea geothermal reservoir (Buttes thermal area) is a minimum of 2x10 to the 19th power calories. That estimate was based on an underlying geothermal reservoir which was assumed to be equivalent to a cylinder 7 km in diameter, 3 km in thickness, having an average temperature of 250 deg C, and an average volumetric specific heat of 0.7 cal/cu cm. The Salton Sea is the largest body of water in California. The total value of physical investments related to the Sea is in the order of $900 million. The Sea's salinity is about 36,000 ppm--slightly more saline than the oceans--and it is increasing; and this increase could be accelerated by the discharge of the still saltier geothermal wastes. Maps, pictures, and tables of data are included. (Woodard-USGS)
W71-00356

SOME GEOLOGICAL CHARACTERISTICS OF SEDIMENTS FROM THE NORTH ATLANTIC OCEAN,
Utrecht Rijksuniversiteit (Netherlands). Vening Meinesz Lab. for Geophysics and Geochemistry.
For primary bibliographic entry see Field 02J.
W71-00362

SOME ASPECTS OF THE DISTRIBUTION, CHEMISTRY, AND MINERALOGY OF SUSPENDED MATTER IN THE GULF OF MAINE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
Derek W. Spencer, and Peter L. Sachs.
Marine Geology, Vol 9, No 2, p 117-136, September 1970. 20 p, 8 fig, 7 tab, 22 ref, append.

Descriptors: *Water chemistry, *Clay minerals, *Solutes, *Suspended load, *Sea water, Mineralogy, Geochemistry, Sampling, Water analysis, Clays, Particle size, Chemical analysis.
Identifiers: Gulf of Maine.

Suspended matter in the Gulf of Maine decreases from the surface to about 50 m and then increases exponentially as the bottom is approached. From 50 m down, the suspended matter is dominantly layer silicates which are interpreted as resuspended bottom material. In the upper 50 m particulate phosphorus, copper, and zinc occur principally in organism. There is, however, little evidence that significant amounts of these elements are reaching the bottom in an organic particulate form, and most appear to be regenerated in the water column. The distributions of particulate Al and Fe are controlled largely by the suspended silicates, and there is no evidence that a free ferric hydroxide phase is important. (Knapp-USGS)
W71-00364

THE NUTRIENT CYCLES OF AN ECOSYSTEM,
Forest Service (USDA), Laconia, N.H. Hubbard Brook Experimental Forest.
F. Herbert Bormann, and Gene E. Likens.
Scientific American, Vol 223, No 4, p 92-101, October 1970. 10 p, 10 fig.

Descriptors: *Nutrients, *Hydrologic budget, *Small watersheds, *Forests, *Cycling nutrients, Ecology, Leaching, Forest management, Clearcutting, Water yield, Energy budget, Food chains, Water chemistry.
Identifiers: Nutrient budget, Nutrient cycle, Forested watersheds, Hubbard Brook Experimental Watershed.

Both hydrologic and nutrient budgets were determined in undisturbed and in devegetated watersheds at Hubbard Brook Experimental Watershed, New Hampshire. The forest has been undisturbed by cutting or fire since 1919. Average annual precipitation is 123 centimeters and runoff is 72 centimeters, with evapotranspiration averaging 51 centimeters. Most of the runoff (57%) occurs during the snowmelt period of March, April and May. The concentrations of potassium, calcium and magnesium hardly change with runoff volume, and the concentration of sodium decreases by only 3 times as the discharge rate increases by 4 orders of magnitude. All these relations show how strongly stream-water chemistry is under the control of processes inherent in the forest ecosystem. The total output of elements is strongly dependent on the volume of stream flow. Deforestation had a pronounced effect on runoff. Treatment also resulted in a fundamental alteration of the nitrogen cycle, which in turn caused extraordinary losses of soil fertility. The capacity of the ecosystem to retain nutrients is dependent on the maintenance of nutrient cycling within the system. When the cycle is broken, as by the destruction of vegetation, the loss of nutrients is greatly accelerated. (Knapp-USGS)
W71-00374

PORE FLUIDS OF RECENT MARINE SEDIMENTS: 1. OXIDIZING SEDIMENTS OF 20 DEGREES N, CONTINENTAL RISE TO MID-ATLANTIC RIDGE,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
James L. Bischoff, and Teh-Lung Ku.
Journal of Sedimentary Petrology, Vol 40, No 3, p 960-972, September 1970. 13 p, 2 fig, 3 tab, 56 ref.
NSF Grant GA 1419.

Descriptors: *Water chemistry, *Connate water, *Atlantic Ocean, *Ion exchange, *Clay minerals, Sea water, Membrane processes, Mass transfer, Thermal water, Mineralogy, Chemical reactions, Sampling, Bottom sediments, Sedimentation.
Identifiers: Mid-Atlantic Ridge.

Pore fluids were extracted on shipboard from 12 deep-sea sediment cores taken during an east to west traverse from Africa to the Mid-Atlantic Ridge, between latitudes 18 deg N and 20 deg N. They were analyzed for Cl, SO4, Mg, Ca, K, Sr, SiO2, B, Li, and Mn. Excepting Cl, SO4, and Ca, which are very close to sea water composition, other components examined are slightly but systematically different from normal sea water. Con-

stancy of Cl in samples of varying clay: $CaCO_3$ ratios negate semipermeable membrane behavior of compacting clays, at least for the top 10 meters of sediment. K and B enrichments mirrored by Mg depletions suggest authigenic chlorite formation at the expense of illite K-feldspar and perhaps montmorillonite. The rather constant SiO_2 level and its enrichment over that of bottom water appear indicative of control by clay-silica equilibria. Minor variations of all elements along depths of cores become magnified and more erratic in the Ridge area, due to heterogeneity of mineralogy or perhaps local hydrothermal effects. (Knapp-USGS)
W71-00386

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
Gerald M. Friedman, and Eliezer Gavish.
Journal of Sedimentary Petrology, Vol 40, No 3, p 930-953, September 1970. 24 p, 43 fig, 2 tab.

Descriptors: *Water chemistry, *Connate water, *Bottom sediments, *Estuaries, Marshes, Lagoons, Brackish water, Saline water systems, Sedimentation, Ion exchange, Clay minerals, Hydrogen ion concentration, Oxidation-reduction potential.
Identifiers: Long Island (NY), Great South Bay (NY).

The chemical characteristics of interstitial waters of sediments of lagoonal, deltaic, river, estuarine, and salt water marsh and cove environments were studied. The chemical characteristics of surface, bottom, and interstitial waters were compared at each core station; in many cores, changes within the sediment profile were also measured. The pH and Eh were measured in surface and bottom waters and at intervals along the core. Values of pH and Eh are lower in interstitial waters than in the overlying waters. In lagoonal and river delta cores, and at the mouth of the river estuary, the chlorinity is higher in interstitial waters. In the river estuary, the chlorinity in the interstitial waters is lower. Biological processes are responsible for the decreases in pH and Eh. Increase in the Ca/Cl ratio and decreases in the ratio of cations to Cl depend on the interaction between clay minerals and water, particularly on cation exchange. (Knapp-USGS)
W71-00388

EFFECTS OF ZOOPLANKTON ON PHOTOSYNTHESIS BY ALGAE IN LAKES,
Richmond Univ., Va. Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-00416

AUTOMATED POTENTIOMETRIC TECHNIQUES FOR THE ON-SITE MONITORING OF ION CONCENTRATIONS IN WATER,
Missouri Univ., Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W71-00474

2L. Estuaries

UNSTEADY FLOW IN CHANNEL OF VARIABLE CROSS SECTION,
University of Strathclyde, Glasgow (Scotland).
John Ellis.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7583, p 1927-1945, October 1970. 19 p, 12 fig, 2 tab, 13 ref, append.

Descriptors: *Estuaries, *Currents (Water), *Unsteady flow, *Tidal effects, *Mathematical models, Computer programs, Model studies, Hydraulics, Inlets (Waterways), Open channel flow, Tides.
Identifiers: Irregular channels.

Characteristic equations describing one-dimensional unsteady open-channel flow in an irregular channel are developed. The integration of these characteristic equations is presented and methods of approximation for the evaluation of the integrals involved in these characteristic equations are considered. The most promising of these numerical integration techniques are incorporated in computer procedures which are linked to form a complete program. This program is used in the modelling of the tidal motion in an inlet of the sea. The particular inlet chosen was one which contained large changes of cross-sectional shape along its length. The varying geometrical properties of the inlet, along its length, are included in the analysis by the preparation of tables of section properties with water level for a series of cross sections. This information is read into the computer at the start of computations. Comparisons are made between computed water levels and actual field records. (Knapp-USGS)
W71-00023

EVIDENCE OF SEAWATER ENRICHMENT BY INFLUX OF SUSPENDED MINERALS FROM FRESH WATER. EXAMPLE THE RHONE (IN FRENCH),
Centre Universitaire de Luminy, Marseille (France). Laboratoire d'Hydrobiologie Marine.
Francois Blanc, Herve Chamley, and Michel Leveau.
Comptes Rendus Academie des Sciences, Paris, Vol 269, No 25, Serie D, p 2509-2512, 1969. 1 fig, 7 ref.

Descriptors: *Saline water-freshwater interfaces, Nutrients, Sea water, Rivers, Seston, Saline water, Illite, Chlorides, Calcium, Watersheds, Quartz, Analytical techniques, X-ray analysis, Precipitation (Atmospheric), Erosion.
Identifiers: Rhone River (France), Minerals, Feldspar.

The progression of the surface water of the River Rhone into the sea was established on the basis of the presence of seston and mineral constituents and a comparison of water salinity. The enrichment of sea water in solids and the decrease in concentration of salts reflected meteorologic conditions and the resulting degree of perturbation of the surrounding uplands. (Wilde-Wisconsin)
W71-00100

THE BENTHIC COMMUNITIES OF LOOSE SUBSTRATA OF THE CONTINENTAL PLATEAU IN THE VICINITY OF THE BANYULS-SUR-MER (IN FRENCH),
Alain Guille.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 189-192, 1970. 1 fig, 1 tab, 9 ref.

Descriptors: *Benthic fauna, *Biological communities, *Distribution patterns, Sands, Gravels, Biomass.
Identifiers: Spisula, Branchiostoma, Amphiura, Nephthys, Venus, Nucula, Scoloplos, Auchenoplax, Catalonian shores (France), Substrate, Subirrigated sands, Infralittoral floors, Circalittoral floors.

The dense network of dredging stations on the Catalonia shore of France led to rediscovery of the biocoenotic relationships of the benthic fauna. The boundaries of the three principal communities are delineated by the nature of the deposits: Spisula subtruncata with multitude of mollusks, confined to fine sands, Branchiostoma lanceolatum of coarse sands and fine gravel, and Amphiura filiformis occupying near-littoral floors. These major associations exhibit a number of subcommunities and still smaller divisions, called facies. Estimates for each community include their area in square kilometers, number of species and specimens per square meter, and biomass in gram/square meter. The obtained results are comparable to some other marine sites such as that of La Manche. As suggested, the general notion about poverty of the Mediterranean benthos must be revised with respect to certain sections. (Wilde-Wisconsin)
W71-00105

WAVE-HEIGHT PREDICTION FOR WAVE GENERATORS IN SHALLOW WATER,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 08B.
W71-00143

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,
Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 02F.
W71-00178

TIDAL STUDY OF THREE OREGON ESTUARIES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
C. R. Goodwin, E. W. Emmett, and Bard Glenne.
Oregon State University Engineering Experiment Station Bulletin No 45, May 1970. 39 p, 17 fig, 5 tab, 21 ref, append. NSF Grant GH-45.

Descriptors: *Estuaries, *Oregon, *Currents (Water), *Tides, Water circulation, Data collections, Hydrologic data, Stratification, Streamflow, Water quality, Water resources development, Water management (Applied), Water levels, Stream gages, Tidal effects.
Identifiers: Yaquina estuary (Oregon), Alsea estuary (Oregon), Siletz estuary (Oregon).

The results of tidal measurements in the Yaquina, Alsea, and Siletz estuaries, Oregon are presented. Investigations of the tidal mechanisms in these estuaries show amplifications of the entrance tidal range throughout the Yaquina estuary. In the Alsea and Siletz estuaries a marked choking of the tidal range takes place through the entrance. In the Alsea the choking continues past Waldport before amplification of the tidal range occurs. A phase difference of 90-100 degrees is found to exist between tidal elevations and tidal currents in the three estuaries. This as well as amplification in the tidal range indicate the presence of reflected waves or resonance conditions. (Knapp-USGS)
W71-00205

LARGE SPRINGS OF FLORIDA'S 'SUN COAST,' CITRUS AND HERNANDO COUNTIES,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02F.
W71-00207

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
For primary bibliographic entry see Field 05D.
W71-00214

EXTENT OF BRACKISH WATER IN THE TIDAL RIVERS OF MARYLAND,
Geological Survey, Towson, Md.
W. E. Webb, and S. G. Heidel.
Maryland Geological Survey Report of Investigations, No 13, 1970. 46 p, 18 fig, 12 tab, 32 ref, append.

Descriptors: *Saline water intrusion, *Estuaries, *Maryland, Tidal effects, Streamflow, Channel morphology, Water quality, Saline water, Salinity.
Identifiers: *Tidal rivers, *Extent of brackish water, Salt-water front.

Fresh-water discharge, tide height and estuary size, shape, and salinity at the mouth are important controls on the extent of brackish water in tidal rivers (estuaries) of Maryland. Long-term predictions of the frequency or times at which brackish water will

penetrate to a given section of an estuary are difficult because of the complex relations between the controls and the lack of quantitative predictions of the controls. Graphs and maps in the report show the historic extent of brackish water and may be used to estimate the probable extent of brackish water in the principal estuaries. For a distance of about 15 miles most of the estuaries will be brackish during one season, but will contain fresh water in the same section during another season of the year. In an estuary section containing a salt front, the water may be fresh at low tide but brackish at high tide. Extremes usually occur twice in 24 hours. The estuaries tributary to Cheaspeake Bay usually contain relatively fresh water for 10 to 30 miles downstream from the point where tidal effect ceases. Data show that brackish water is flushed downstream by a sudden increase in discharge for a length of channel which will accomodate the volume discharged. (Woodard-USGS)
W71-00215

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
For primary bibliographic entry see Field 05B.
W71-00231

STOCHASTIC ASPECTS OF LAKE ONTARIO EVAPORATION,
Rutgers - The State Univ., New Brunswick, N.J.
For primary bibliographic entry see Field 02D.
W71-00233

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
For primary bibliographic entry see Field 05B.
W71-00236

ESTUARY ENTRANCE UMPQUA RIVER, OREGON--HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-00308

SOME ASPECTS OF THE DISTRIBUTION, CHEMISTRY, AND MINERALOGY OF SUSPENDED MATTER IN THE GULF OF MAINE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-00364

MAGNETIC FABRIC OF SEDIMENTS FROM THE SHELF AT LA JOLLA (CALIFORNIA),
Southampton Univ. (England).
For primary bibliographic entry see Field 02J.
W71-00367

PHYSICAL DATA OF POTOMAC RIVER TIDAL SYSTEM INCLUDING MATHEMATICAL MODEL SEGMENTATION,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05G.
W71-00375

EFFECTS OF HURRICANES CAMILLE AND LAURIE ON THE BARATARIA BAY ESTUARY,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Rodney Adams.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 47-52, February 1970. 6 p, 5 fig. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Beach erosion, *Hurricanes, *Surges, *Louisiana, *Estuaries, Waves (Water), Currents (Water), Water levels, Water level fluctuations, Floods, Damages, Geomorphology, Topography, Beaches, Deltas, Lakes.

The two late-season hurricanes, Camille and Laurie, passed to the east and south of the Barataria Bay estuary but did produce above-normal tides and accumulations of wind-driven debris. Maximum winds with Camille reached 45 to 65 miles per hour at Grand Isle and were from the east and north when the most severe effects were felt. Laurie shifted to an easterly course when she was still 175 miles south of Grand Isle, and no severe winds were experienced. Rapid water-level rise was accompanied by high winds from the east and northeast, which drove vast quantities of marsh grass debris against buildings and embankments. There were no significant changes to the shoreline from Southwest Pass to the mouth of Bayou Lafourche. However, aerial photographs taken immediately after the storm show what appears to be small washover fans to the east of Grand Isle on Grand Terre and Shell Island. (Knapp-USGS)
W71-00379

SOURCE AND DISPERSION OF SURFACE SEDIMENTS IN THE GULF OF MAINE--GEORGES BANK AREA,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02J.
W71-00387

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-00388

TURBID BOTTOM WATER ON THE CONTINENTAL SHELF OF THE NORTHERN BERING SEA,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W71-00390

AN ECOLOGICAL SURVEY OF A SANDY BEACH,
Naval Postgraduate School, Monterey, Calif.
Thomas Joseph Berger.
Available from NTIS as AD-709 087, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, April 1970. 42 p.
Identifiers: *Beaches, *Ecology, Environment, Sand, Grain size, Invertebrates, Tides, Annelida, Arthropods, Crustacea, Thesis, Nephtys caecoides, Nephtys californiensis, Archaeomysis maculata.

An ecological survey of a sandy beach was made to determine relationships between population densities and sand grain size distributions, season and height above the tidal datum plane (MLLW). Fifteen species of invertebrates in four phyla were collected. Four zones relative to tidal datum and two major habitats - protected outer coast sandy beach and outer coast sandy beach - were defined. Nephtys californiensis and Archaeomysis maculata showed distinctive distribution patterns relative to mean grain size which require further investigation.
W71-00418

TEXAS MARINE RESOURCES: THE LEISURE VIEW,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 06B.
W71-00438

WATER RESOURCES IN THE TAMPA BAY REGION OF FLORIDA: HILLSBOROUGH, PINELLAS, MANATEE AND SARASOTA COUNTIES.
Tampa Bay Regional Planning Council, St. Petersburg, Fla.

Available from NTIS as PB-192 410, $3.00 in paper copy, $0.95 in microfiche. Briley, Wild and Assoc., April 1970. 193p.
Identifiers: *Management planning, Florida, Water supplies, Natural resources, Statistical data, Housing, Industries, Recreation, Control, Wastes (Sanitary engineering), Storage, Rainfall, Agriculture, Statistical analysis, Storms, Salvage, *Tampa Bay Region (Florida), Hillsborough County (Florida), Pinellas County (Florida), *Manatee County (Florida), *Sarasota County (Florida), *Area planning, Development, *Wateruse.

The Report includes an inventory of the Region's total water resource; estimates of future water use requirements; recommendations for a continuing program for the development of alternative and supplemental water sources, and a recommended plan for the conservation, development and management of the Region's water resources.
W71-00447

THE RELATIONSHIP BETWEEN WATERSHED GEOLOGY AND BEACH RADIOACTIVITY,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02J.
W71-00453

INTERACTIONS OF THE BEACH-OCEAN-ATMOSPHERE SYSTEM AT VIRGINIA BEACH, VIRGINIA,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-00468

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 01B.
W71-00040

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
Donald F. Klodt.
Denver University, Denver Research Institute Final Report to Office of Saline Water, October 1968. 32 p, 16 fig, 3 tab, 3 ref. OSW Contract No 14-01-0001-1335.

Descriptors: *Corrosion, *Desalination plants, *Inhibition, *Design criteria, *Corrosion control, Chemical properties, Chemical reactions, Chlorides, Damages, Structural design, Evaluation, Laboratory tests, Desalination apparatus.
Identifiers: Desalination equipment materials.

Laboratory corrosion tests were conducted on 8 alloys in both aerated and deaerated brackish water. The alloys were all commercially available alloys normally used as materials of construction in desalination plants and were tested in the welded and non-welded condition. Flow velocities of 6 to 8 ft/sec were generally used, although some tests were conducted with the flow velocity being 12 to 16 ft/sec. The maximum test temperature was 125

deg C. Corrosion rates were determined from weight loss data after a minimum exposure period of 350 hours. Anodic polarization curves were determined for the alloys under static and velocity conditions and over a range of temperatures from 25 deg C to 75 deg C in brackish water using potentiostatic techniques. The effects of velocity of flow and/or temperature on the passivity of the alloys were determined. Correlations between the various alloys and between the potentiostatic data and velocity corrosion data were made where possible. The titanium alloy (2.5Sn-5.0A1) demonstrated the best corrosion resistance and could be passivated anodically under both static and velocity conditions for temperatures below 45 deg C. (Knapp-USGS)
W71-00064

SEEDING OF BRACKISH WATER IN A SPRAY FILM EVAPORATOR,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
John E. Jones, Jr.
Available from NTIS as AD-706 225, $3.00 in paper copy, $0.95 in microfiche. Report 1972, January 1970. 35 p.
Identifiers: *Desalination, *Corrosion inhibitation, *Sulfates, *Corrosion, Chemical precipitation, Evaporators, Calcium compounds, Sprays, *Brackish water, *Scale (Corrosion), Calcium sulfate.

When operating on many brackish waters, sea water distillation equipment becomes inoperative in a short time because of heavy deposits of calcium sulfate scale. Investigations are being made to evaluate a calcium sulfate crystal-seeding method for prevention of this scale formation in evaporators. The report covers tests performed at the Office of Saline Water, Roswell Test Facility to investigate the use of crystal-seeding techniques to inhibit the formation of sulfate scale in a horizontal-tube, spray-film evaporator. These crystal-seeding techniques were evaluated on a raw well water and well water with silica removed. A control test without crystal seeding was also conducted. The results of these tests indicate that on all waters tested, the crystal-seeding process can inhibit the formation of evaporator scale in a horizontal-tube, spray-film evaporator.
W71-00463

TREATMENT OF ACID MINE DRAINAGE OF REVERSE OSMOSIS.
Rex Chainbelt, Inc., Milwaukee, Wis.
For primary bibliographic entry see Field 05A.
W71-00477

RESEARCH ON IMPROVED REVERSE OSMOSIS MEMBRANES,
Gulf General Atomic, Inc., San Diego, Calif.
H. K. Lonsdale, R. L. Riley, C. E. Milstead, L. D. La Grange, and A. S. Douglas.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25. Office of Saline Water Research and Development Progress Report No. 577, October 1970. 143 p, 46 tab, 28 fig, 62 ref. OSW Contract 14-01-0001-1778.

Descriptors: *Permselective membranes, *Membranes, *Osmosis reverse, *Desalination, Ion transport semipermeable membranes, Demineralization brackish water, Sea water, Demineralization, Diffusion, Osmosis.
Identifiers: *Composite membranes, Ultrathin films.

The principal objective was the development of a new concept in the preparation of reverse osmosis membranes. These membranes consisted of a very thin desalinating film suitably supported by a finely porous substrate. Much of the development was based on thin films of cellulose acetate with a high degree of substitution and a porous substrate consisting of mixed cellulose nitrate and cellulose acetate. The development has proceeded to the point where seawater desalinating membranes can be prepared and it is believed that the technique can be readily scaled up. At 1500 psi and with 3.5% NaCl brine, water fluxes of 10 gal./ft sq-day and salt rejections of 99.5% were achieved. Several other approaches in preparing new desalinating membranes were studied. These included interpolymer membranes from polyvinylpyrrolidone and several polyisocynates; polyelectrolyte membranes prepared by dip coating or casting a film of polyacrylic acid on a finely porous support membrane; and a micromosaic membrane for desalination by piezodialysis. The most promising was the polyacrylic acid membrance which could be useful for brackish water desalination. The properties of cellulose acetate membranes were explored in greater detail. The rejection of a number of inorganic and organic compounds and several salt mixtures were examined using the cellulose acetate membranes. (Kindley-Office of Saline Water)
W71-00481

MULTIPLE PHASE EJECTOR PILOT PLANT,
Kaye (Joseph) and Co., Inc., Cambridge, Mass.
John Leigh.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $2.25. Office of Saline Water Research and Development Progress Report 578. June 1970. 64 p, 30 fig, 8 ref. OSW Contract 14-01-0001-2105.

Descriptors: Desalination, *Distillation, *Evaporators, Jets, *Pilot plants.
Identifiers: *Multiple phase ejector, Steam-jet ejector, *Steam generator, Water-jet ejector, Vertical tube evaporator.

A pilot plant was designed, constructed, tested and turned over to an operating contractor at the Office of Saline Water, Wrightsville Beach Test Facility, Wrightsville Beach, North Carolina. The pilot plant utilizes a Multiple Phase Ejector having an availability efficiency of 30 percent with driving-stream inlet state at 500 deg F and 10 percent vapor quality, a horizontal spray film evaporator, and an oil-fired steam generator. This plant produces approximately 5000 pounds per hour of distillate and provides 2000 pounds per hour of dry saturated steam at 265 deg F to run a neighboring five-effect VTE pilot plant. The VTE pilot plant is capable of producing approximately an additional 10,000 pounds per hour of distillate. The combined plant demonstrates the ability of the MPE plant to reduce the net heat requirement per pound of distillate produced in the VTE plant, alone, from about 200 BTU to approximately 150 BTU in the combined plant. (Robinson-Office of Saline Water)
W71-00482

3B. Water Yield Improvement

NEW DEVELOPMENTS IN ATMOSPHERIC WATER RESOURCES,
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.
Archie M. Kahan, and Richard L. Eddy.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 1-41, 1970. 41 p, 8 fig, 1 tab, 37 ref.

Descriptors: *Cloud seeding, *Water yield improvement, *Reviews, Weather modification, Clouds, Nucleation, Statistical methods, Chemistry of precipitation, Meteorology, Rain, Water supply, On-site tests, Water management (Applied), Water resources development.
Identifiers: Atmospheric water management.

Cloud seeding for precipitation management is reviewed with emphasis on recent work in the United States. The present status in the field can be described as extremely encouraging when attention is given to single cloud experiments or limited area seeding in winter storms. A number of cloud-seeding techniques have been developed. Ground-based seeding, using silver iodide generators, is the most commonly used technique, especially for winter storms in mountainous terrain. Airborne seeding, using silver iodide or crushed dry ice, is frequently employed with summer convective storms. Careful attention must be given to matching the techniques (or tools) needed to form a balanced system to accomplish the job. A true precipitation management system should have: (1) a component to analyze the present and expected water needs and water sources, plus the anticipated effects of precipitation management; (2) a component to recognize weather in which precipitation management would result in the desired effect (or undesirable effects); (3) a component to select the proper treatment material and delivery system; and (4) a component to assess the results. The projects briefly reviewed include statistically designed studies in the United States and abroad, and long-term commercial projects. (Knapp-USGS)
W71-00006

GEOBOTANIC APPROACH FOR IMPROVEMENT OF RANGE RESOURCES IN DESERT AND SEMI-DESERT AREAS OF KAZAKHSTAN, USSR,
Central Arid Zone Research Inst., Jodhpur (India).
A. K. Chakravarty.
Paper based on lectures given by Soviet Specialists in a seminar at Alma-Ata, Kazakhstan, USSR, April-May, 1966. Author sponsored by FAO. Annals of Arid Zone, Vol 8, No 2, p 251-256, September 1969. 1 fig, 1 tab, 5 ref.

Descriptors: *Mapping, *Arid lands, *Pasture management, *Water distribution (Applied), *Productivity, Semiarid climates, Animals, Vegetation, Grasses, Water conservation, Deserts, Dry seasons, Moisture deficity, Range management, Seasonal.
Identifiers: *USSR, *Kazakhstan Republic, *Animal husbandry.

The Kazakh Republic possesses vast natural pasture lands, most of which are in desert and semi-desert zones. Almost all agriculture involves animal husbandry based on the fodder production of the natural pastures. However, annual climatic fluctuations lead to seasonal water deficits, thereby limiting productivity. Therefore, extensive studies were undertaken to devise increased production methods. Vegetational maps were constructed and surveys undertaken of soils, relief, vegetational associations, grass productivity, haymowing, land usage, range conditions, irrigation and cultivation. Plant nutritive values were determined and animal management practices were reviewed. The ultimate goals--at least in part accomplished--were to establish an ecological balance between animals and long term pasture usage on the basis of higher quality pastures and better seasonal water catchment methods. Surface and groundwater utilization are described. Exploitation of groundwater for increasing dry season production is important. (Casey-Arizona)
W71-00146

AGRICULTURAL EVOLUTION IN ISRAEL IN THE TWO DECADES SINCE INDEPENDENCE,
Oklahoma Univ., Norman. Dept. of Geography; Southwestern State Coll., Weatherford, Okla. Dept. of Geography; and West Florida Univ., Pensacola. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-00148

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00150

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
H. S. Nagabhushanaiah.
Annals of Arid Zone, Vol 8, No 2, p 287-290, September 1969. 5 fig.

Descriptors: *Arid lands, *Shallow wells, *Hydrogeology, *Filters, *Groundwater basins, Artesian wells, Aquifers, Pervious soils, Infiltration, Permeability, Deserts, Wells.
Identifiers: *Infiltration galleries.

When large amounts of water for irrigation are drawn from shallow wells, overdraft may be avoided by the use of infiltration galleries, which are horizontal wells surrounded by graded filters. Groundwater is collected along their lengths and carried to the pumping well. Infiltration galleries are widely used around the world, but are restricted to shallow wells because of filter maintenance and location problems at greater depths. They are, therefore, rarely used in arid regions where groundwater levels are deep. There are, however, 2 exceptional hydrogeological situations where the use of infiltration galleries are feasible in the desert: (1) isolated shallow groundwater basins resulting in an artesian supply from a confined aquifer to an overlying unconfined aquifer and (2) shallow water tables due to backwater storage when an impermeable soil intercepts permeable soils. Factors in the design of appropriate infiltration galleries are discussed. Seepage flow for a given set of boundary conditions may be determined by the flow net method. (Casey-Arizona)
W71-00152

WATER-REPELLENT SOILS AND ANNUAL PLANT COVER IN A DESERT SCRUB COMMUNITY OF SOUTHEASTERN CALIFORNIA,
California Univ., Riverside. Dept. of Life Sciences.
For primary bibliographic entry see Field 02G.
W71-00158

STUDY OF WATER RESOURCES IN THE CHAD BASIN.
United Nations Educational, Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 06D.
W71-00161

ON THE POSSIBILITY OF WEATHER MODIFICATION BY AIRCRAFT CONTRAILS,
Alaska Univ., College. Geophysical Inst.
For primary bibliographic entry see Field 02B.
W71-00369

INVENTORY AND ANALYSIS OF EXISTING WATER SUPPLY SYSTEMS AND POTENTIAL SOURCES OF SUPPLY, VOLUME IV.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 04A.
W71-00434

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 05G.
W71-00480

3D. Conservation in Domestic and Municipal Use

CITY OF CORAL GABLES V CRANDON (ESTABLISHMENT OF WATER CONSERVATION DISTRICT).
For primary bibliographic entry see Field 06E.
W71-00062

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'N (ADMINISTRATIVE ORDER TO SUPPLY WATER).
For primary bibliographic entry see Field 06E.
W71-00091

WHITE V WELSH (AUGMENTATION OF UTILITY CAPACITY).
For primary bibliographic entry see Field 06E.
W71-00093

KUEHN V VILLAGE OF MAHTOMEDI (CONFLICT BETWEEN PUBLIC AND PRIVATE OPERATORS OF WATER SYSTEMS).
For primary bibliographic entry see Field 06E.
W71-00094

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'M (PUBLIC UTILITIES REGULATION).
For primary bibliographic entry see Field 06E.
W71-00098

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 06D.
W71-00315

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-00324

3E. Conservation in Industry

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 06D.
W71-00315

ESTIMATED WATER USE IN FLORIDA, 1965,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-00376

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM SALLISAW, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 313, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 64 p.
Identifiers: *Urban planning, *Oklahoma, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Sallisaw (Oklahoma), *Sequoyah County (Oklahoma).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development, including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00456

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, DESHA COUNTY, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 312, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 64 p.
Identifiers: *Urban planning, *Arkansas, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Desha County (Arkansas).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00457

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, VAN BUREN, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 311, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 72 p.

Descriptors:
Identifiers: *Urban planning, *Arkansas, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Van Buren (Arkansas), *Sebastian County (Arkansas), *Crawford County (Arkansas).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development, including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00458

3F. Conservation in Agriculture

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 04A.
W71-00033

AGRICULTURAL EVOLUTION IN ISRAEL IN THE TWO DECADES SINCE INDEPENDENCE,
Oklahoma Univ., Norman. Dept. of Geography; Southwestern State Coll., Weatherford, Okla. Dept. of Geography; and West Florida Univ., Pensacola. Dept. of Geography.
Arthur H. Doerr, Jerome F. Coling, and William S. Kerr, III.
Middle East Journal, Vol 24, No 3, p 319-337, Summer 1970. 3 fig, 49 ref.

Descriptors: *Water conservation, *Water transfer, *Crop production, *Rainfall, *Agriculture, Soil properties, Climatology, Topography, Economic efficiency, Arid lands, Semiarid climates, Planning, Irrigation, Moisture deficit, Specialty crops, Marketing, Sewage effluents, Saline water, Drainage systems.
Identifiers: *Israel, *Mediterranean agriculture.

Israel is a small, overpopulated country with marginal agricultural resources which has applied enormous scientific and technological methods in developing a crop agriculture. The emphasis on increased productivity has taken place within basically Mediterranean agricultural patterns--hardy perennials, winter grown annuals and irrigated specialties. A review of the physical environment reveals climatic patterns which cause an overall national water deficit and generally marginal edaphic and topographic conditions. The northern areas have a relatively favorable water economy, and irrigation and drainage projects within those locales are described. A national plan of water transfer from favored to more arid regions is in operation and is controlled by the Federal Government. When completed, a 120 mile interregional complex of water diversion structures will exist. Water is considered a state property and its use is carefully regulated. Additionally, major water conservation schemes are under development. Two of the most important concern saline water irrigation systems and utilization of sewage effluents. Efficient modern Israeli marketing schemes in western Europe for specialty crops are described. (Casey-Arizona)
W71-00148

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W71-00165

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
For primary bibliographic entry see Field 06G.
W71-00209

RESPONSE OF AGRICULTURAL CROPS TO FLOODING, DEPTH-OF-WATER TABLE AND SOIL GASEOUS COMPOSITION,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
R. E. Williamson, and George J. Kritz.
American Society Agricultural Engineers Transactions, Vol 13, No 2, p 216-220, March-April 1970. 5 p, 1 fig, 3 tab, 49 ref.

Descriptors: *Crops, *Agriculture, *Saturated soils, *Soil gases, Water table, Plants, Root develolpment, Aeration.

Agricultural crops vary genetically and physiologically and thus require different soil water regimes for optimum production. To specify an optimum water-table depth, it is necessary to know at least the crop species, soil characteristics and watering procedure. Generally, grasses tolerate high water tables very well during cool seasons when the plants are dormant. Some crops such as strawberries are adversely affected by large fluctuations in the yearly water table (high in winter, low in summer). When a water table rises above some of the root system during a growing season and remains at a higher than normal level for more than one or two days, severe root pruning results. Experiments relating root function and plant performance to duration and extent of root system inundation should provide useful information for drainage design. Laboratory work has shown the root and shoot response of several plant species to various root zone gaseous compositions under varying conditions of temperature and radiant energy. Both in field and laboratory studies, relative to the problem of excess water and crop production, the air and water regime in relation to root function and total plant performance throughout its production cycle is the basic consideration. To restrict attention to the problem of excess water removal from a land area or to the specification of optimum water-table depths tends to obscure the real dimensions of the problem. Tables and curves relating data of the study are included. (Woodard-USGS)
W71-00217

EFFECT OF WATER-TABLE LEVELS ON EVAPOTRANSPIRATION AND CROP YIELD,
Agricultural Research Service, Raleigh, N.C. Soil and Water Div.
For primary bibliographic entry see Field 02D.
W71-00219

ENGINEERING AND ECONOMIC RELATIONS IN THE SELECTION AND CLASSIFICATION OF IRRIGABLE LANDS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 06B.
W71-00262

DRAINAGE PROBLEMS AND THE PROPOSED SOLUTION FOR A LARGE IRRIGATED AREA IN THE SAN JOAQUIN VALLEY OF CALIFORNIA (USA),
Westlands Water District, Fresno, Calif.
William R. Johnston.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.247-26.262, Mexico City, 1969. 16 p, 4 fig, 2 tab, 8 ref.

Descriptors: Irrigation, *Drainage, *Drainage costs, *Irrigated land, Drainage districts, Drainage engineering, Agriculture, Drainage systems, Perched water table, Saline water, Saline soils, *Waterlogged land, Costs, Design, Farms, Effluents, Groundwater.
Identifiers: San Joaquin Valley (Calif), San Luis Drain (Calif), *Irrigated agriculture, *Westlands Wtr Dist (Calif).

Under an irrigated agriculture regime, drainage problems develop slowly over many years before high groundwater or excess salinity affects the economy of an area. This is particularly true in an area where the irrigation program is accomplished with a limited water supply on slowly permeable soils and where drainage is impossible because of the absence of a suitable outlet. The 240,000-ha Westlands Water District, located in the semiarid San Joaquin Valley of California, is unique in that even prior to the time an annual delivery of 1,200,000 acre-ft of imported water was applied to the land, it was one of the most intensively cultivated irrigated agricultural areas in the world. The area has been irrigated for 25 to 30 yr, using a limited underground water supply pumped from depths of 120 to 240 m. Only a minimal water supply has been used in the area, but a perched water table has developed over approximately one-sixth of the District land, causing severe drainage problems and high salinity conditions in the crop root zone. The problem of agricultural drainage in this area is complex, but is being solved through local, state, and Federal cooperation. (USBR)
W71-00267

THE RELATIONSHIP AMONG THE FEDERAL GOVERNMENT DISTRICT BOARDS, MANAGERS AND WATER USERS ON NEW IRRIGATION AND DRAINAGE PROJECTS,
Bureau of Reclamation, Denver, Colo.
James M. Ingles.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.207-26.220, Mexico City, 1969. 14 p, 7 ref.

Descriptors: Irrigation, *Irrigation districts, *Water users, Costs, Federal Government, Irrigation operation and maintenance, Administration, Management, *Drainage districts, Decision making, State governments, Organizations, Training, Personnel, Associations, Planning.
Identifiers: Operating criteria.

An understanding of the functional relationship among project beneficiaries (water users) and various state and national organizations having direct or indirect responsibilities contributes significantly to the ultimate success of irrigation and drainage projects. The primary functional relationships that have evolved in the past century in the U S in organizing and managing new irrigation projects are discussed. The state is the subnational level of government that usually establishes legislative authority for water users' organizations and regulatory powers related thereto, especially in use of water. The National Government is the highest political institution of a country, and usually establishes policies and participates in land and water resource programs in the national interest. Water users' organizations consist of 3 groups: (1) the board of directors--the elected governing body; (2) the operating staff--usually a hired manager and employees; and (3) the individual water users--landowners and operators. Transition from operation of a project by the National Government to the ultimate objectives of self-operation by water users' organizations and the obligations and responsibilities involved are discussed. (USBR)
W71-00268

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

UNSTEADY SEEPAGE TOWARD NARROW DITCH,
Washington Univ., Seattle. Dept. of Civil Engineering.
Bruce W. Hunt.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7586, p 1953-1963, October 1970. 11 p, 5 fig, 1 tab, 4 ref, append.

Descriptors: *Ditches, *Seepage, *Unsteady flow, *Groundwater movement, Water levels, Aquifers, Water table, Drainage, Recharge, Drains, Surface-groundwater relationships.
Identifiers: Unsteady seepage.

A linearized solution is obtained for the unsteady, free surface seepage toward a ditch in an infinitely deep aquifer. The complex potential is defined to be the solution of a first order, linear, partial differential equation, and examination of the general solution for this equation reveals that a seepage surface cannot be imposed along the ditch boundary in the linearized model. A numerical example is treated, and it is pointed out that the same results can be used to describe the unsteady recharge of an aquifer under similar boundary conditions. (Knapp-USGS)
W71-00021

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
E. S. Joseph.
Water Resources Research, Vol 6, No 4, p 1199-1201, August 1970. 3 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Droughts, *Planning, *Frequency analysis, *Design, *Water supply, Reliability, Reservoir design, Reservoir operation, Runoff forecasting, Water yield.
Identifiers: Design drought.

Certain problems associated with a drought frequency analysis were studied and their solutions are proposed. The techniques are based on a probabilistic framework. Return period of a project's design drought (the annual drought for which a water resource project such as a treatment plant or a low flow augmentation system has to be designed) is treated as a function of the project's useful life and the desired level of assurance. Assurance is the probability of nonoccurrence of droughts equal to or smaller than the design drought during the project's useful life. A method is given for estimating the probability and return period associated with the design drought of a project. A chart gives recurrence intervals of design droughts for various combinations of the estimated useful life of a project and the desired level of assurance. (Knapp-USGS)
W71-00025

FLOOD PLAIN INFORMATION, MINNESOTA RIVER, GRANITE FALLS, MINNESOTA.
Corps of Engineers, St Paul, Minn.

U S Army Corp of Engineers Flood Plain Report, June 1970. 44 p, 13 fig, 16 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Granite Falls (Minnesota), Standard project flood, Intermediate regional flood.

Flooding along the Minnesota River and its overflow channels within the City limits of Granite Falls, Minnesota is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00026

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.

Tennessee Valley Authority and North Carolina State Univ Cooperative Report - Project Authorization No 445.1 Final Report published by Tennessee Valley Authority, June 1970. 115 p, 29 fig, 5 plate, 14 tab, 3 append.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *North Carolina, Hydrology, Evapotranspiration, Soil conservation, Water conservation, Tennessee Valley Authority project, Overland flow, Runoff, Lysimeters, Gaging stations.
Identifiers: Experimental watersheds.

The hydrology of 6 small watersheds in Western North Carolina was studied from 1949 to 1970 to obtain information on the effects of agricultural covers on runoff. As watershed size diminishes, the effects of differences in soils become more pronounced and hydrometeorological variations over relatively small distances may become significant. Significant differences were found in the stormflow response attributable to the agricultural covers. On areas with deep permeable topsoils, the hydrologic differences among well-managed covers were minor, whereas with relatively impermeable topsoils, the cover and its management were found to have a much larger impact upon stormflow response. Runoff is contributed in an inverse relation to the capacity to (1) infiltrate and store rainfall and (2) store or transmit interflow. In farm planning, cover management should be related to the depth of the A horizon. In areas of thin or impermeable A horizon, and downslope from these areas, the best conservation covers, such as pasture, should be grown. In urban planning, provisions should be made for preserving sites with deep permeable soils as moisture storage zones. Typically, the alluvium along stream bottoms meets these criteria, and these areas should be preserved as 'green belts.' Paving or roofing of areas with fairly impermeable topsoils will not significantly change streamflow characteristics. (Knapp-USGS)
W71-00033

BRESHERS V NINETEENTH LA LEVEE DIST (DAMAGES RECOVERABLE FOR INJURY CAUSED BY LEVEE CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00053

FLOOD PLAIN INFORMATION, BEARGRASS AND UPPER MILL CREEKS, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

Corps of Engineers Flood Plain Report, August 1969. 61 p, 25 fig, 15 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Kentucky, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Jefferson County (Ky), Louisville (Ky), Standard project flood, Intermediate regional flood.

Flooding of Beargrass and Upper Mill Creeks, Jefferson County, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00054

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AND CAPE LA CROIX CREEK, CAPE GIRARDEAU, MO.
Corps of Engineers, St. Louis, Mo.

Corps of Engineers Flood Plain Report, December 1969. 60 p, 14 fig, 16 plate, 16 tab.

Descriptors: *Floods, *Flood damage, *Mississippi River, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cape Girardeau (Mo), Standard project flood, Intermediate regional flood.

Flooding of the Mississippi River and Cape La Croix Creek, Cape Girardeau, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00055

FLOOD PLAIN INFORMATION, OHIO RIVER, KENTON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

US Army Corps of Engineers Flood Report, December 1968. 34 p, 8 fig, 9 plate, 7 tab.

Descriptors: Floods, *Flood damage, *Ohio River, *Kentucky, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Kenton County (Kentucky), Standard project flood, Intermediate regional flood.

Flooding along the Ohio River in Kenton County, Kentucky is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating to extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00065

FLOOD PLAIN INFORMATION, OHIO RIVER, CAMPBELL COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

US Army Corps of Engineers Flood Plain Report, December 1968. 34 p, 8 fig, 13 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Ohio River, *Kentucky, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Campbell County (Kentucky), *Flood records, Standard project flood, Intermediate regional flood.

Flooding along the Ohio River in Campbell County, Kentucky is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00066

FLOOD PLAIN INFORMATION, FLORENCE, SOUTH CAROLINA.
Corps of Engineers, Charleston, S.C.

US Army Corps of Engineers Flood Plain Report, October 1967. 40 p, 8 fig, 15 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *South Carolina, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, Standard project flood, Intermediate regional flood.

Flooding along Jefferies Creek, Beaverdam Creek, Rye Branch, Gum Branch, and Gulley Branch in the vicinity of Florence, South Carolina is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00067

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Body, G. Erdos, and K. Szesztay.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 280-288, 1968. 9 p, 7 fig.

Descriptors: *Digital computers, *Streamflow forecasting, *Gaging stations, *Time, Equations.
Identifiers: *Danube River.

Digital computer systems of gauge-relations were determined in order to forecast discharges of the

Danube River at the Iron-Gate section using data from 17 stations for roundly 2000 days for 5 and 10 day periods. Regularities of the streamflow regime of the river were described by relations between the discharges of selected gauging stations. Comparison of indices characterizing the closeness of gauge-relations derived on the basis of changes of discharges corresponding to different time intervals were applied for the determinination of travel times even under conditions of backwater effect. Special forecast equations were established for each day on the basis of data most characteristic for the streamflow regime conditions of the given day. (See also W71-00071) (Kriss-Cornell)
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
D. M. Rockwood.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 329-344, 1968. 16 p, 4 fig, 6 ref.

Descriptors: *Digital computers, *Hydrology, *Synthesis, *Streamflow, *Reservoir operation.
Identifiers: Mekong River.

The general concepts of the streamflow synthesis and reservoir regulation-'SSARR'-program, togehter with highlights of its application to the Mekong River Hydrologic and Reservoir Regulation analyses were presented. Digital computer utilization and a discussion of areas of application to hydrologic engineering were given. The original version of the 'SSARR' program was developed in 1957. The computer program described in this paper was a 'third generation' program for streamflow synthesis. It was designed as a hydrologic and reservoir regulation model with application to a much wider range of conditions than the previous version and it greatly expanded logic for simulating hydrologic processes, channel routing techniques and reservoir regulation methods. The program provided a framework for future studies of hydrologic analyses of the Mekong River. (See also W71-00071) (Kriss-Cornell)
W71-00080

MISSISSIPPI STATE HIGHWAY COMM'N V YELLOW CREEK DRAINAGE DIST (BRIDGE CONSTRUCTION ENJOINED AS BEING INTERFERENCE WITH MAINTENANCE OF DRAINAGE DISTRICT).
For primary bibliographic entry see Field 06E.
W71-00081

HENRITZY V HARRISON COUNTY (RIGHT OF WAY SECURED VIA CONDEMNATION FOR SEA WALL CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00083

WARREN V GEORGIA POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER FROM DAM).
For primary bibliographic entry see Field 06E.
W71-00086

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
M. J. Burley, and J. A. Cole.
The Use of Analog and Digital Computers in Hydrology, Vol II, p 584-590, 1968. 7 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Optimization, *Digital computers, *Dynamic programming, *Reservoirs, *Desalination plants, Surface waters, Costs, Risks.
Identifiers: Linked water resources.

The subject of linked water resources was viewed from two main aspects: (1) the computational problem of operating two linked storages optimally, for any given hydrology, given capacities, and fixed economic parameters of operation; and (2) the conjunctive use of a desalination plant and a surface water impoundment, at a given deficit risk. Month by month control rules were formulated by digital computer. Example (1) used a dynamic programming approach based on inflow probabilities, and catered for 64 possible combinations of reservoir contents and proceding inflows. Example (2) used a search of 34 years of inflows to find a 'worst case' basis for deciding at what reservoir contents the desalination plant should start to operate. By adopting the control rule it was shown that the linked system reduced operating costs by 30 to 50% below those of a year round supply by desalination. (See also W71-00071) (Kriss-Cornell)
W71-00088

KELLOG V HOTTMAN (INTERFERENCE WITH FLOW OF FLOODWATERS).
For primary bibliographic entry see Field 06E.
W71-00089

DETROIT TRUST CO V DINGMAN (AUTHORITY OF DRAINAGE DISTRICTS TO ALLOW INCIDENTAL SEWAGE DISPOSAL THROUGH DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-00092

LAGE V POTTAWATTAMIE COUNTY (FLOOD DAMAGE RESULTING FROM PUBLIC ACTIVITY).
For primary bibliographic entry see Field 06E.
W71-00096

JOHNSON V STARR (NEGLIGENT DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00126

FINSETH V SPERRY (MAINTENANCE OF DRAINAGE SYSTEMS).
For primary bibliographic entry see Field 06E.
W71-00147

SINK V CITY OF LEXINGTON (LIABILITY FOR DAMAGE CAUSED BY BACKWATER FROM MUNICIPAL DAM).
For primary bibliographic entry see Field 06E.
W71-00206

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER (LOMPOC TO PACIFIC OCEAN), SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps of Engineers Flood Plain Report, January 1970. 51 p, 37 fig, 25 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *California, *Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Santa Barbara County (Cal), Standard project flood, Intermediate regional flood.

Flooding of the Santa Ynez River, Santa Barbara County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00208

FLOOD PLAIN INFORMATION, WHITE OAK CREEK, ROCK CREEK AND TOWN BRANCH, SULPHUR SPRINGS, TEXAS.
Corps of Engineers, New Orleans, La.

Corps of Engineers Flood Plain Report, September 1969. 39 p, 6 fig, 37 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Sulphur Springs (Tex), Standard project flood, Intermediate regional flood.

Flooding in Sulphur Springs, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00224

ON THE DESIGN AND CONSTRUCTION OF INFILTRATION GALLERIES,
For primary bibliographic entry see Field 08A.
W71-00258

DRAINAGE PROBLEMS AND THE PROPOSED SOLUTION FOR A LARGE IRRIGATED AREA IN THE SAN JOAQUIN VALLEY OF CALIFORNIA (USA),
Westlands Water District, Fresno, Calif.
For primary bibliographic entry see Field 03F.
W71-00267

EISENSTEIN V MAYOR, COUNSELOR AND ALDERMEN (CITY'S DRAINAGE SYSTEM MUST BE ADEQUATE TO ACCOMMODATE USUAL RAINFALL).
For primary bibliographic entry see Field 06E.
W71-00279

MULTIRESERVOIR OPERATION STUDIES,
Arizona Univ., Tuscon; and Network Analysis Corp., Port Washington, N.Y.
For primary bibliographic entry see Field 06A.
W71-00281

THE WATERSHED IN PRINCIPLE,
Syracuse Univ., N.Y.
Peter E. Black.
Water Resources Bulletin, Vol 6, No 2, p 153-162.

Descriptors: *Watersheds (Basins), *Watershed management, *Planning, On-site data collections, Water control, Evaluation, Decision making.
Identifiers: *Fundamental concepts, Electrical analogy.

Three fundamental concepts linking drainage basin characteristics, stream behavior, and management of watersheds are deduced from field data and observations. An electrical analogy of a watershed clarifies definitions and broadens understanding of this complex natural resource. The three basic principles deal with: (1) The interrelationships of watershed morphology, constitution, and appearance; (2) the nature of the control man can exert over runoff-influencing forces, and (3) the efficiency of watershed management efforts. Recognition of these principles can assist educators, managers, planners and researchers to more fully inform students and to more effectively guide and evaluate management decisions. (Marriott-Chicago)
W71-00319

LAND AND WATER RESOURCES MANAGEMENT FOR ENVIRONMENTAL IMPROVEMENT,
Department of Agriculture, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-00320

FLOOD PLAIN MODELING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Frank E. Perkins.
Water Resources Bulletin, Vol 6, No 3, p 375-385, May-June 1970. 5 fig, 7 ref.

Descriptors: *Computer models, *Mathematical models, *Rainfall-runoff relationship, River basins, Simulated rainfall, Water management (Applied), Flood control.

Computer simulation of river basin hydrology has progressed from an interesting academic exercise to a practical engineering procedure of increasing utility. Mathematical models of the many interrelated processes which occur in a basin have been developed along with efficient numerical procedures for their solution. This paper is concerned with a particular model which has been used to describe the transformation of a temporarily and spatially varying rainfall into a time history of stage and discharge on a flood plain. Although developed as a model of the physical processes involved, it is envisioned that the model can serve as one component of an information system for flood plain planning and management. The model consists of three elements: (1) a rainfall simulation which generates stochastic inputs to the model according to specified rainfall statistics, (2) a catchment-runoff model which converts the rainfall to surface runoff, (3) a flood stage model which converts the surface runoff to time histories of flood stage and discharge. The model has been used to investigate the effect of various structural for each of these. Of particular interest in development of the model have been recurring and partially unanswered questions relative to the proper balance among availability of data for use in the model, data requirements of the model and the objectives of the outputs produced by the model. (Marriott-Chicago)
W71-00321

JOINT PROBABILITY METHOD OF TIDE FREQUENCY ANALYSIS APPLIED TO ATLANTIC CITY AND LONG BEACH ISLAND, N. J.,
Weather Bureau, Silver Spring, Md.
Vance A. Myers.
Environmental Science Services Administration Technical Memorandum WBTM HYDRO 11, April 1970. 109 p, 41 fig, 20 tab, 20 ref.

Descriptors: *Tides, *Surges, *Hurricanes, *Statistical models, *Probability, Frequency analysis, Tidal energy, Flood forecasting, New Jersey, Storms, Waves (Water), Wave pile-up, Wind tides.
Identifiers: Joint probability, Tide frequency.

This paper describes the frequency analysis of combined storm surges and periodic tides prepared by ESSA as part of the Long Beach Island (New Jersey) study. These frequencies apply to the ocean beach. The Long Beach Island study is a pilot study in a new area. It is intended to serve as a guide to other studies of other coastal communities as well as to provide needed criteria at this one location. The frequency curve is extended beyond observed storm data by including hypothetical tides calculated from hypothetical storms chosen so as to represent future possibilities. Recent advances in the technique of computing surges from hurricane wind fields by solving simplified forms of the applicable dynamic equations make it possible to determine surges in a statistical manner for several hundred hypothetical hurricanes, representing different combinations of climatological hurricane characteristics. In calculating hypothetical tides, storm surges are combined with the astronomical tide in a random manner rather than being made coincident with astronomical high tide only. This joint probability approach is described in detail. (Knapp-USGS)
W71-00378

AN ANNUAL REPORT OF THE CHEMICAL CONTROL OF ALLIGATORWEED,
University of Sourthwestern Louisiana, Lafayette. Dept. of Chemical Engineering.
F. W. zur Burg, J. A. Foret, S. L. Solymosy, W. K. Averitt, and J. R. Barry.
Southwestern Louisiana University - Department of the Army, Corps of Engineers Cooperative Investigation, June 30, 1970. 231 p, 15 chart, 24 tab, 3 ref. Corps of Engineers Contract DACW-68-C-0006.

Descriptors: *Aquatic weed control, *Alligatorweed, *Herbicides, *Aquatic weeds, Weed control, Vegetation regrowth, Defoliants, Plant growth regulators.
Identifiers: (2,4-D).

When alligatorweed is treated with the chlorinated phenoxy type herbicides, the above-water portions of the plant are destroyed and regrowth takes place from one or more nodes beneath the water. Therefore, work was directed toward some method that would act on the secondary growth. Herbicides were applied to water in a pellet form to allow extremely slow release. Attempts were also made to disperse droplets of an oil soluble form of 2, 4-D into the water and then to add coagulating agents which would collect some droplets of 2, 4-D on the nodes and other underwater parts. No single commercial herbicide was found satisfactory. Phenoxy herbicides are most useful when applied to the roots of the plant. Application of 2, 4-D plus Silvex plus molasses gave the best results, a 90% kill below water. Some new chemicals, notably Ethrel, gave fair results. A virus disease which weakened plants should be studied as a possible control method. (Knapp-USGS)
W71-00396

FLOOD CONTROL AND DRAINAGE IN INDIA,
Central Water and Power Commission, New Delhi, (India).
P. N. Kumra.
Water Resources Journal, United Nations Economic Commission for Asia and the Far East (ST/ECAFE/SER. C/83), p 27-38, December 1969. 12 p.

Descriptors: *Floods, *Flood control, *Non-structural alternatives, Warning systems, Flood plain zoning, Reservoirs, Floodways, Channel improvement, Cost-benefit analysis.
Identifiers: *India.

Though floods in India are as old as the rivers themselves, the floods of the last decade and, more recently, of October 1968, have given rise to serious concern. With the development activities and increase in population in the country, there has been continued encroachment on the flood plains of the rivers with the result that the floods of the same intensity cause more damage now than before. The States affected by recurring floods are Andhra Pradesh, Assam, Bihar, Haryana, Jammu and Kashmir, Orissa, Punjab, Uttar Pradesh and West Bengal. The flood-protection methods in use can be broadly classified as (1) administrative and (2) engineering. Aministrative methods consist of flood forecasting and warning, and flood-plain zoning. One category of works aims at reducing the magnitude of the flood flows at the damage center, thereby reducing the spill and consequent damage. In the other category, the intensity of floods is not reduced but an attempt is made to reduce the damage by confining the flood flows and preventing spilling. Such works include embankments and channel improvements. (Knapp-USGS)
W71-00400

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 05D.
W71-00409

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWER OVERFLOWS - BUCYRUS, OHIO.
Burgess and Niple Ltd., Columbus, Ohio.
For primary bibliographic entry see Field 05D.
W71-00412

BURIED ASPHALT MEMBRANE CANAL LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Fred H. Geier, and William R. Morrison.
Available from NTIS as PB-193 143, $3.00 in paper copy, $0.95 in microfiche. Research Report No. 12, 1968, 58 p.
Identifiers: *Inland waterways, Bituminous coatings, *Asphalt, Bituminous coatings, *Bituminous coatings, Aging (Materials), Test methods, Moistureproofing, *Canal linings.

Analysis of test results and visual observations on membrane samples after 14 years' service did not reveal any serious deficiencies in the asphalt membrane lining. Of the 112 field samples evaluated from 20 different canal installations, more than 80 percent demonstrated satisfactory resistance to field aging. The membranes in poor condition resulted from accelerated aging primarily due to defective construction practice. Test results indicated that thickness is one of the more important factors contributing to life of the asphalt membrane. For a majority of the membranes evaluated, the change in physical properties due to field aging did not materially affect their ability to provide a flexible, watertight lining. Tests indicated that the greatest portion of this change occurs during the first 6 years of service. After this period, the rate of change is slower. An aging index was calculated through a computer program to determine the relative change in the physical properties of the membrane. This study reaffirms the point that adequate seepage control will be maintained for many years if the membrane is installed in accordance with current specifications.
W71-00433

INVENTORY AND ANALYSIS OF EXISTING WATER SUPPLY SYSTEMS AND POTENTIAL SOURCES OF SUPPLY, VOLUME IV.
Valley Regional Planning Agency, Ansonia, Conn.

Available from NTIS as PB-192 941, $3.00 in paper copy, $0.95 in microfiche. Malcom Pirmi Engineers, White Plains, N.Y., February 1970. 45p.
Identifiers: *Urban planning, *Connecticut, *Water supplies, Urban planning, Rivers, Water wells, Consumption, Industries, Statistical analysis, *Regional planning and development, *Sewers, Water resources, Watersheds.

The report is the fourth of a five-folume series prepared to serve as part of the basis for an area-wide water/sewer plan and program for the Valley Region. The present volume includes an inventory and evaluation of the major water supply systems and potential sources of supply existing or being developed to serve the Valley Region.
W71-00434

WATER AND SEWERAGE STUDY, SECOND PHASE.
Morris County Planning Board, Morristown, N.J.
For primary bibliographic entry see Field 05G.
W71-00435

A MASTER SEWERAGE PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 05G.
W71-00436

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
For primary bibliographic entry see Field 08A.
W71-00441

RICHMOND REGIONAL SEWERAGE PLAN AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00445

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00446

SURFACE STORM WATER RUNOFF AND DRAINAGE STUDY FOR ESSEX COUNTY, NEW JERSEY.
Essex County Planning Board, Belleville, N.J.

Available from NTIS as PB-192 358, $3.00 in paper copy, $0.95 in microfiche. December 1969. 55 p.
Identifiers: *Management planning, New Jersey, *Economics, *Storms, Drainage, Design, Soils, Terrain, Surfaces, Geology, Construction, Structures, Statistical data, Tables, Urban areas, *Essex County (New Jersey), *Regional planning, Area planning, Development, *Storm sewers, *Surface water runoff, Watersheds.

The report analyzes storm frequency information and provides a study design prototype applicable county-wide for small watershed developments. Physical characteristics and surface imperviousness studies were made relating criteria of physical properties of soils, geology, topography (slope) and future land use to storm runoff expectations consistent with County and municipal comprehensive planning programs. Recommendations were made for future programs and measure required to better plan for future storm drainage facilities in Essex County.
W71-00448

WATER AND SEWER FACILITIES PLAN: VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05G.
W71-00450

STORM DRAINAGE IN THE TOLEDO REGIONAL AREA.
Toledo Regional Area Plan for Action, Ohio.

Available from NTIS as PB-191 387, $3.00 in paper copy, $0.95 in microfiche. Regional Report 9.3. Office of the Lucas County Engineer, September 1969. 118 p.
Identifiers: *Drainage, Urban planning, *Ohio, Drainage, Terrain, Inventory, Floods, Sanitary engineering, Standards, Problem solving, Budgets, Combined sewers, *Storm sewers, *Toledo (Ohio).

The report is an inventory and analysis of existing storm drainage systems. The collected information provides a basis for solving immediate drainage problems, guiding new development to those areas amenable to good drainage, and planning for future drainage improvements. Subject areas covered by the study include: planning and financing of storm drainage facilities; general standards for storm drainage systems; mapping of watershed areas; computation of storm water runoff and water surface elevations. Two important problem areas examined are flooding and combined sewers.
W71-00454

WATER AND SEWER PLAN FOR THE TUSCALOOSA METROPLITAN AREA.
Tuscaloosa Area Council of Local Governments, Ala.
For primary bibliographic entry see Field 05G.
W71-00459

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05D.
W71-00476

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 05G.
W71-00478

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.
For primary bibliographic entry see Field 05G.
W71-00479

SIMULATION OF CONTINUOUS DISCHARGE AND STAGE HYDROGRAPHS IN THE NORTH BRANCH OF THE CHICAGO RIVER.
Hydrocomp International, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 02E.
W71-00483

MATTHEWS V UNITED STATES (LIABILITY FOR CONSEQUENTIAL FLOODING CAUSED BY FLOOD CONTROL PROJECT).
For primary bibliographic entry see Field 06E.
W71-00496

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-00499

MOBILE AND O RR V RED FEATHER COAL CO (LIABILITY FOR OBSTRUCTION TO FLOW OF INTERMITTENT STREAM).
For primary bibliographic entry see Field 06E.
W71-00529

GUILLORY V FONTENOT (PROPER USE OF FLOODGATES NOT AN OBSTRUCTION TO NATURAL DRAINAGE OF LAND).
For primary bibliographic entry see Field 06E.
W71-00534

BESLER V GREENWOOD (INJUNCTION TO PREVENT OBSTRUCTING NATURAL FLOW OF DRAINAGE WATER).

212 NW 120-121 (Iowa 1927).

Descriptors: *Iowa, *Obstruction to flow, *Damages, *Tile drains, Watercourses (Legal), Alteration of flow, Riparian rights, Riparian land, Riparian waters, Relative rights, Drains, Tiles, Ditches, Bank erosion, Outlets, Overflow, Drainage water, Judicial decisions, Legal aspects, Surface waters, Surface runoff, Natural flow.

Plaintiff and defendant owned adjacent lands. Plaintiff sought an injunction against defendant's placing of obstructions in a natural drainage ditch which drained plaintiff's and defendant's property. Plaintiff also sought damages caused by water which backed up on his property allegedly due to such obstructions. The court stated that plaintiff had a right to drain his land in the general course of the natural drainage by constructing a covered drain discharging the water at the point the water would naturally flow into a natural water course. Plaintiff was entitled to an injunction restraining defendant from obstructing the flow of water in the ditch. However, plaintiff's claim to damages was not sustained since no evidence appeared showing whether the backup was due to defendant's obstructions or to a sack found in plaintiff's tile drain, both of which would have been sufficient to effectuate the overflow. The trial court's judgment for defendant was affirmed in part and reversed in part. (Price-Florida)
W71-00550

4B. Groundwater Management

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.
For primary bibliographic entry see Field 06B.
W71-00010

ELECTRIC ANALOG MODEL EVALUATION OF A WATER-SALVAGE PLAN, SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
Philip A. Emery.
Colorado Water Conservation Board Groundwater Series Circular No 14, 1970. 11 p, 4 fig, 3 plate, 1 tab, 7 ref.

Descriptors: *Analog models, *Water management (Applied), *Groundwater basins, *Evapotranspiration control, *Withdrawal, Groundwater, Water levels, Water level fluctuations.
Identifiers: San Luis Valley (Colo).

An electric analog model was constructed as part of a water-resources appraisal study of the San Luis Valley in south-central Colorado. The model is used to synthesize the hydrology of the valley and to predict the effects of changes in water management. The plan called for salvaging water being consumed by nonbeneficial vegetation in the central part of the valley by pumping a network of wells. This part of the valley is internally drained. The model was used to predict the effects of pumping annually about 84,000 acre-feet of water from 129 wells for a 50-year period. The predicted decline in groundwater levels ranged from 1 to 100 feet. The major part of the water pumped is groundwater that would have been lost to evapotranspiration (84%) and the remainder is from groundwater storage (14%) and the Rio Grande (2%). (Knapp-USGS)
W71-00034

RESULTS OF TEST DRILLING AT THE CENTRAL GREAT PLAINS FIELD STATION NEAR AKRON, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00037

GROUNDWATER RESOURCES OF THE LOWER HILLSBORO CANAL AREA, SOUTHEASTERN FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02F.
W71-00039

HYDROGEOLOGIC DATA FOR THE LOWER ARKANSAS RIVER VALLEY, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00047

A STUDY IN THE GROUNDWATER HYDROLOGY OF THE MEERUT DISTRICT, UTTAR PRADESH, INDIA,
Banaras Hindu Univ., Varanasi (India). Dept. of Geography.
For primary bibliographic entry see Field 02F.
W71-00057

WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00060

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California Dept. of Water Resources; and TRW Systems Group, Redondo Beach, Calif.
E. M. Weber, H. J. Peters, and M. L. Frankel.
Use of Analog and Digital Computers in Hydrology, Vol I, p 215-223, 1968. 9 p, 4 fig.

Descriptors: *Computer programs, *Digital computers, *Groundwater basins, *Optimization, *cost, *Mathematical models, Management.

A computerized approach to the planning studies of integrated management of groundwater basin supplies, storage and transmission, conjunctively with surface water supplies, storage and transmission, developed since 1959, was described. A two spaced-dimensional diffusion mathematical model of the groundwater basin was developed which incorporated the nonlinear features of transmissibility variation with saturated thickness, rising and repercolating waters, and transmissibility variation (constrictions) at depth. Mathematical models of pipeline networks were developed to simulate the hydraulic characteristics of the expanding system and maximum delivery capacities were estimated. Selection of the digital approach was related to data availability, the sensitivity of the economic analysis to the scale of the physical model, and the application of digital computers in the economic analysis phase of the studies. Digital model validation was speeded by on-line hydrograph plots. A cost equation was developed to determine the most economical combination of pumping and surface storage facilities. The studies described and the models discussed have been used in studies of many geographical locations. (See also W71-00071) (Kriss-Cornell)
W71-00073

THE ARCHIVES FOR GROUNDWATER LEVELS T.N.O. IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
For primary bibliographic entry see Field 02F.
W71-00144

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
For primary bibliographic entry see Field 03B.
W71-00152

ROCK MOVEMENT TRIGGERED BY A WATER-LEVEL CHANGE IN THE BRUNSWICK AREA, GEORGIA,
Geological Survey, Brunswick, Ga.
For primary bibliographic entry see Field 02F.
W71-00177

NONSTEADY INFLOW TO A CHAMBER WITHIN A THICK AQUITARD,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00179

DETERMINING TRANSMISSIVITY FROM WATER-LEVEL RECOVERY OF A STEP-DRAWDOWN TEST,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W71-00180

OPTIMIZATION OF CONJUNCTIVE USE OF WATER IN A STREAM-AQUIFER SYSTEM, USING LINEAR PROGRAMMING,
Geological Survey, Denver, Colo.
O. James Taylor.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C218-C221, 1970. 4 p, 2 fig, 5 tab, 3 ref.

Descriptors: *Conjunctive use, *Surface waters, *Aquifers, *Surface-groundwater relationships, *Optimization, Computer programs, Linear programming, Water demand, Irrigation water, Water resources development, Water management (Applied), Colorado.
Identifiers: Arkansas River (Colo).

A linear program was used to show how conjunctive use of groundwater and surface water in a stream-aquifer system can be manipulated to minimize depletion of the stream. The program was designed to achieve the objective by satisfying the demand for irrigation water, using groundwater and surface water selectively during a 2-month period. If the irrigation system of a river basin can be reduced to a series of linear equations of tolerable errors, a great deal of insight is provided by the solution and sensitivity analysis of a linear program. The results of the program are highly dependent on the specified constraints which should be based on field measurements. (Knapp-USGS)
W71-00182

GEOLOGY AND GROUNDWATER RESOURCES OF PITT COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02F.
W71-00188

USE OF ALLUVIAL FAULTS IN THE STORAGE AND RETENTION OF GROUNDWATER,
Department of Water and Power, Los Angeles, Calif.
Dennis E. Williams.
Groundwater, Vol 8, No 5, p 25-29, September-October 1970. 5 p, 5 fig, 5 ref.

Descriptors: *Artificial recharge, *Water management (Applied), *Groundwater movement, *Faults (Geology), Water storage, Alluvium, Aquifers, Water spreading.
Identifiers: Owens Valley (Calif).

Recent investigations of the faults in California's Owens Valley reveal that they are semipervious, or leaky in nature. The rate of groundwater movement through a semipervious alluvial fault is dependent upon the hydraulic conductivity of the fault gouge, the thickness of this zone, and the water-level differential across the fault. Optimization of the groundwater resources in the Owens Valley is currently practiced using these faults in a controlled recharge-extraction-salvage system. In a system of this type, artificial recharge is induced into the Valley's aquifers upgradient from alluvial fault zones. Salvage of groundwater is accomplished by lowering the water table in the vicinity of these faults. (Knapp-USGS)
W71-00196

DETERMINING THE SUSTAINED YIELDS OF WELLS IN CARBONATE AND FRACTURED AQUIFERS,
Pennsylvania State Univ., University Park. Mineral Conservation Section.
Richard R. Parizek, and Shamsul H. Siddiqui.
Groundwater, Vol 8, No 5, p 12-20, September-October 1970. 9 p, 7 fig, 2 tab, 11 ref.

Descriptors: *Water yield, *Aquifers, *Karst, Limestones, Fractures (Geology), Transmissivity, Drawdown, Groundwater movement, Hydrogeology, Theis equation, Water levels.
Identifiers: Well testing, Aquifer evaluation.

Carbonate aquifers with highly developed anisotropic permeabilities and other fractured rocks under water-table or semiwater-table conditions present complex hydrologic settings in which to predict the sustained yield of individual wells or groups of wells. Yields of wells in these settings are particularly responsive to the position of the water level and its relationship to one or more producing zones. Often total well capacity may be accounted for by a few openings separated by essentially nonproductive rock. A permeability profile must be defined for these wells. Permeability profiles may be roughly estimated from detailed driller's logs and caliper logs, and more precisely determined from flow meter surveys, packer tests and by pumping wells after successive increments of drilling or by a combination of increasing casing lengths and extended drilling. Test holes may be drilled immediately adjacent to the potential production well to define the inclination of individual conduits or wells test pumped when possible at rates sufficient to draw the pumping level to the top of the opening in question. (Knapp-USGS)
W71-00201

SMALL WELLS MANUAL--A MANUAL OF LOCATION, DESIGN, CONSTRUCTION, USE AND MAINTENANCE,
Minnesota Univ., Minneapolis. Div. of Environmental Health.
For primary bibliographic entry see Field 08A.
W71-00305

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
George A. Dinwiddie.
Geological Survey Open-file Report USGS-474-80, June 1970. 110 p, 56 fig, 5 tab, 1 ref. Contract AT (29-2)-474 USAEC.

Descriptors: *Hydrogeology, *Aquifers, *Igneous rocks, *Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.
Identifiers: Aquifer testing, Well testing, Pumping tests.

This report, prepared in support of the U. S. Atomic Energy Commission's underground nuclear testing program in central Nevada, presents basic data obtained during hydraulic tests in six exploratory holes before February 1968. The wells penetrated alluvium, welded tuff, bedded tuff, and rhyolite. (Knapp-USGS)
W71-00307

DYNAMIC PROGRAMMING FOR OPTIMUM CONJUNCTIVE USE,
Nevada Univ., Reno. Desert Research Inst.
Gilbert F. Cochran, and William S. Butcher.
Water Resources Bulletin, Vol 6, No 3, p 311-322, May-June 1970. 6 fig, 1 tab, 12 ref.

Descriptors: *Water management, *Dynamic programming, *Conjunctive use, *Water utilization, *Water distribution (Applied), Water costs, Economics, Legal aspects, Water Law.
Identifiers: Las Vegas (Nevada).

This study was designed to determine how best the Las Vegas Valley Water District might intergrate the use of the existing groundwater and anticipated imported surface water. The consequences of certain provisions in the Nevada Water Law were examined to determine their effects on the groundwater system and costs of water. A dynamic programming technique was utilized. The problem as formulated consists of a single decision variable, single state variable dynamic programming algorithm evaluated over a fifty-year planning horizon at monthly intervals. In all solutions operating rules regarding groundwater pumping distribution and use of surface-water system are kept constant. The problem is considered deterministic in all respects. Optimization of conjunctive use of the water district is based on the objective function of minimizing water production costs. Results of the study are presented as a series of policy traces under each of the three alternatives considered. These traces describe the groundwater basin response under optimal operating conditions, given an estimate as to the present worth of groundwater pumping rights, and prescribe monthly water-procurement schedules for the operation of the water district. It is concluded that by using dynamic programming techniques it is possible to examine some economic and physical effects of groundwater conservation measures on a relatively complex system over a long period of time; and provides an optimal operating guide to system utilization for a given set of physical, legal, and economic parameters. (Marriott-Chicago)
W71-00323

COMPUTATION OF RATE AND VOLUME OF STREAM DEPLETION BY WELLS,
Geological Survey, Washington, D.C.
C. T. Jenkins.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402--Price $0.30. Geological Survey Techniques of Water-Resources Investigations, Book 4, Chapter D1, 1970. 17 p, 5 fig, 3 tab, 13 ref.

Descriptors: *Surface-groundwater relationships, *Conjunctive use, Groundwater movement, Induced infiltration, Water management (Applied), Water table, Water wells, Water yield, Water levels, Equations, Streamflow.
Identifiers: Stream depletion by wells.

The depletion in flow of a nearby stream caused by pumping a well can be calculated by using dimensionless curves and tables. Computations can be made of (1) the rate of stream depletion at any time during the pumping period or the following nonpumping period (2) the volume of water induced from the stream duing any period, pumping or nonpumping, and (3) the effects, both in rate and volume of stream depletion, of any selected pattern of intermittent pumping. Sample computations illustrate the use of the curves and tables. An example shows that intermittent pumping may have a pattern of stream depletion not greatly different from a pattern for steady pumping of an equal volume. The residual effects of pumping, that is, effects after pumping stops, on streamflow may often be greater than the effects during the pumping period. Adequate advance planning that includes consideration of residual effects thus is essential to effective management of a stream-aquifer system. (Knapp-USGS)
W71-00354

GROUNDWATER IN GREENE COUNTY, NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02F.
W71-00363

4C. Effects on Water of Man's Non-Water Activities

COMPILATION OF HYDROLOGIC DATA, AUSTIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02E.
W71-00041

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
For primary bibliographic entry see Field 05A.
W71-00142

EFFECTS OF URBANIZATION ON THE QUALITY OF SELECTED STREAMS IN SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W71-00175

INFLUENCE OF LAND USE ON RUNOFF FROM AGRICULTURAL WATERSHEDS,
Ohio State Univ., Columbus.
V. T. Ricca, P. W. Simmons, J. L. McGuinness, and Paul E. Taiganides.
American Society Agricultural Engineers Transactions, Vol 13, No 2, p 187-190, March-April 1970. 4 p, 3 fig, 5 tab, 6 ref. OWRR Project B-005-Ohio.

Descriptors: *Watershed management, *Land use, *Runoff, *Agriculture, Streamflow, Rainfall, Reforestation, Groundwater, Water table, Percolation, Hydrology, Hydrologic data.
Identifiers: North Appalachian Experimental Watershed (Ohio).

Thirty years of runoff data from agricultural watersheds at the North Appalachian Experimental Watershed were analyzed to determine the effects of land use on streamflow. Reforestation and improved cropping reduced annual and seasonal streamflow. High flows were reduced in both seasons, but the treatment effects on low flows were not consistent. A decrease in percolation potential was indicated by the declining trend of the November 1 groundwater level. The time trend of flow changed from strongly negative in the first 10 years to insignificant in the last 10 years of record, indication that the major effects of land use and treatment on streamflow have been reached. Hydrologically, the treated watersheds have stabilized in their new flow regimes. (Woodard-USGS)
W71-00218

SOME OBSERVATION OF STREAMFLOW AND WATER QUALITY IN THE URBAN ENVIRONMENT,
Geological Survey, Washington, D.C. Water Resources Div.
Andrew M. Spieker.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968) ed. Phillip Cohen, Martha N. Francisco, p 742-753. 10 fig, 3 ref.

Descriptors: *Streamflow, *Water quality, *Urbanization, Low-flow augmentation, Dissolved oxygen, Biochemical oxygen demand, Dissolved solids, Coliforms, Sewage effluents, Sludge disposal, Storm runoff, Groundwater.
Identifiers: *Salt Creek basin, Water quality parameters, Metropolitan Sanitary District of Greater Chicago, Combined sewage systems.

The effects of urbanization on the hydrologic regimen are studied through observation of the Salt Creek basin in Illinois from 1940 to 1965. Although most studies of urban hydrology have been concerned with the effects of urbanization on low flows may be significant. Flow-duration curves from two gaging sites show differences between four subsidiary periods between 1951 and 1965. Changes in sewage disposal practices, such as affiliation with Metropolitan Sanitary District of Greater Chicago, may reduce flow almost completely during day periods. On the other hand, where a community operates its own treatment plant, increased population bring about increased sewage effluent discharge. Variations in water quality with streamflow are indicated using four parameters: dissolved oxygen (DO), biochemical oxygen demand (BOD), coliform bacteria, and total dissolved solids. Other parameters which have been ignored but which are necessary to give a complete picture of water quality are listed. Nevertheless, DO and BOD readings at several locations during flooding conditions and low flow conditions show favorable DO readings during the flooding period. Exceptions are explained as resulting from untreated discharge from combined sewer systems. Regarding dissolved solids, concentration is much higher at low flow. Coliform bacterial counts were higher during high flows with combined sewers, accumulated sludge in the streambed, and storm runoff as important contributors. Discussion is given to augmenting low flows and to clearing and cleaning accumulated sludge deposits from stream bottoms. (Preckwinkle-Chicago)
W71-00318

SEDIMENT PROBLEMS IN URBAN AREAS,
Geological Survey, Washington, D.C.
Harold P. Guy.
Available free on application to the U.S. Geological Survey, Washington, D.C. 20242. Geological Survey Circular 601-E, 1970. 8 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Urbanization, *Sedimentation, *Soil erosion, *Stream erosion, Sediment load, Sediment transport, Damages, Water law, Floods, Flood damages, Cities, Water pollution sources.
Identifiers: Urban sediment sources.

Soil erosion and sediment deposition in urban areas are as much an environmental blight as badly paved and littered streets, dilapidated buildings, billboard clutter, inept land use, and air, water, and noise pollution. In addition, sediment has many direct and indirect effects on streams that may be either part of or very remote from the urban environment. Sediment, for example, is widely recognized as a pollutant of streams and other water bodies. Much of the disturbed soil in urban construction areas erodes and becomes sediment in streams; the sediment damages water-control works and aquatic habitat, degrades water quality, increases flood damages, and lowers the environmental attractiveness. During the process of stabilization of an area after construction, streams tend to erode their beds and banks as a result of increased runoff. Documentation of erosion sources and amounts, of sediment concentration in runoff, of stream-channel changes, and of the location and amounts of deposition together with an economic analysis of sediment damages and a pertinent research program provides the knowledge needed to find the best solutions to a wide variety of existing and future urban sediment problems. (Knapp-USGS)
W71-00393

4D. Watershed Protection

EFFECTS OF GROUNDWATER SEEPAGE ON FLUVIAL PROCESSES,
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W71-00028

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02A.
W71-00072

WATER-REPELLENT SOILS AND WETTING AGENTS AS FACTORS INFLUENCING EROSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02G.
W71-00157

CHANNEL-SCARP FORMATION IN WESTERN NORTH DAKOTA,
Geological Survey, Grand Forks, N. Dak.
Thomas M. Hamilton.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C229-C232, 1970. 4 p, 3 fig, 6 ref.

Descriptors: *Stream erosion, *Alluvial channels, *Gully erosion, *Small watersheds, *North Dakota, Channel erosion, Alluvium, Rainfall-runoff relationships, Channel morphology, Arid lands, Sediment transport, Sedimentation, Vegetation effects.
Identifiers: Channel scarps.

A reconnaissance of the present gully system and valley surfaces of small drainage basins in western North Dakota indicates that channel-scarp formation may most often be the result of one of three general conditions. These conditions are: (1) cutoff of the downvalley toe of alluvial fill in tributaries by encroachment of a migrating main channel; (2) cutting on a local reach of steeper gradient as a result of (a) an extreme flood, (b) a shift toward greater precipitation causing channel degradation on the steeper reach, or (c) short time-separation between two storms; and (3) piping collapse. (Knapp-USGS)
W71-00185

EVALUATION OF A SINGLE LAYERED GRADED GRAVEL AS A PROTECTIVE FILTER,
Missouri Water Resources Research Center, Columbia.
Clifford D. Muir.
Available from NTIS as PB-195 084, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, Aug 27, 1970. 10 p, 101 tab, 2 fig, 7 ref, 2 append. OWRR Project A-028-MO (2).

Descriptors: Erosion, Seepage, Slope protection, *Erosion control, Road banks, *Filters, Gravels, Porous media.
Identifiers: *Gravel layer, Particle migration.

A laboratory study was conducted to evaluate the feasibility of using a random graded single layer of gravel as a protective filter against embankment erosion due to seepage. This evaluation was based on the observation of movement of particles from a fine sand layer into filters with considerable variation in gradation. Also varied were the quantity and direction of flow. Forty one tests gave over six hundred individual penetration depths. These tests indicated that an increased thickness of filter layer can be used to replace fineness of gradation. Correlation between penetration depths for all gradations was obtained using an approximated average hydraulic radius for each filter. Te data on penetration patterns and relationships between penetration depth and average hydraulic radius should be helpful in the design of a random graded single layer protective filter.
W71-00413

BENEFICIAL USE OF WATERSHEDS (IMPROVEMENT OF WATERSHED MANAGEMENT; NECESSITY FOR NEW WATER-ALLOCATION POLICY TO ACCOUNT FOR THE INCREASE IN RECREATIONAL USE).
For primary bibliographic entry see Field 06E.
W71-00487

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

REVEALING BY PHYSICAL PROCEDURE THE SHORT-DURATION FLUCTUATIONS IN THE DENSITY OF VEGETATION OF MOUNTAIN STREAMS. DEFINITION OF A NEW BIOLOGICAL TEST IN WATER ANALYSIS, THE BIOCHEMICAL DEMAND FOR MINERAL SALTS (IN FRENCH),
For primary bibliographic entry see Field 02I.
W71-00104

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
George F. Weisel, and Robert L. Newell.
Available from NTIS as PB-194 756, $3.00 in paper copy, $0.95 in microfiche. Bulletin 38, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Montana, Aug. 1970. 16 p, 6 tab, 8 fig, 18 ref. OWRR Project No. A-018-MONT (2).

Descriptors: *Water quality, *Pollutant Identification, *Turbidity, Dissolved solids, Hardness (Water), Alkalinity.

The water quality of 25 headwater creeks and the Blackfoot River, all tributaries to the Clark Fork of the Columbia, was investigated. Most of the qualities analyzed exhibit definite seasonal trends. Turbidity, total residue, and percent of residue from settleable solids are the most variable, particularly in watersheds which have been roaded and logged. The pH values are generally 7.4--8.6. The water is most basic during summer months and becomes less so during snow and rain runoff. The only acid stream was one which receives seepage from old mine tailings. The levels of total hardness, calcium hardness, and alkalinity decreases with increased runoff. Total dissolved solids, calcium, magnesium, bicarbonates, and chlorides are at highest levels during low water. They are derived mostly from water percolated through surface runoff. In general, the spring fed streams and streams used for irrigation contain the greatest amounts of dissolved materials. The streams maintain a high level of dissolved oxygen seldom less than 8 mg/l. Photosynthesis and nocturnal respiration are unimportant in effecting the amount of dissolved oxygen in these mountain streams. Carbon dioxide is present in amounts less than 2 mg/l.
W71-00142

MERCURY BIBLIOGRAPHY,
Eastman Kodak Co., Rochester, N.Y. Kodak Park Div.
Don H. Anderson.
Eastman Kodak Company, Kodak Park Division Mercury Bibliography, August 10, 1970. 1 p, 9 ref.

Descriptors: *Chemical analysis, *Trace elements, *Poisons, *Laboratory tests, Water analysis, Pollutant identification, Photometry, Flame photometry.
Identifiers: Mercury, Mercury analysis.

A brief bibliography of nine reports and background information on detection and analysis of trace amounts of mercury is available from Eastman Kodak Company, Rochester, New York, 14650. Reprints of reports on lab procedure originated by Kokak are also available. (See also W71-00168 through W71-00172) (Knapp-USGS)
W71-00167

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY,
Eastman Kodak Co., Rochester, N.Y.
Albert E. Ballard, and C. D. W. Thornton.
Industrial and Engineering Chemistry, Vol 13, No 12, p 893-897, December 15, 1941. 5 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Mercury resonance radiation of wave length 2537 angstroms is absorbed by mercury vapor. If a constant source of this radiation is placed at one end of a tube and a narrow-band photoelectric cell sensitive to this line is placed at the other end, a microammeter, connected through an amplifying system to the photocell, will indicate the amount of light falling on the cell. If the tube contains mercury vapor, some of the light will be absorbed and the microameter will give a different reading from that given when no mercury vapor is in the light path. The method presented allows the determination of 0.02 to 0.60 microgram of mercury in 150 to 400 cc of solution. Using a battery of recovery units, an operator can make 25 determinations per day. The method may be used with water-miscible solvent mixtures and with solutions from the digestion of solid organic materials. It is applicable to the estimation of mercury in biological materials after suitable preliminary digestive treatment. (See also W71-00167) (Knapp-USGS)
W71-00168

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY - USE OF G.E. GERMICIDAL ULTRAVIOLET INTENSITY METER,
Eastman Kodak Co., Rochester, N.Y.
C. W. Zuehlke, and A. E. Ballard.
Analytical Chemistry, Vol 22, p 953-954, July 1950. 2 p, 3 fig, 1 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Instructions are given for constructing an inexpensive photometric mercury-detection device using commercially available parts. The instrument determines 0.02 to 0.60 micrograms of mercury in 150 to 400 cc of solution. The method may be used with water-miscible solvent mixtures and with solutions from the digestion of solid organic and biological materials. (See also W71-00167) (Knapp-USGS)
W71-00169

PHOTOMETRIC MERCURY ANALYSIS - CORRECTION FOR ORGANIC SUBSTANCES,
Eastman Kodak Co., Rochester, N.Y. Research Labs.
Albert E. Ballard, David W. Stewart, Warren O. Kamm, and Carl W. Zuehlke.
Analytical Chemistry, Vol 26, p 921-922, May 1954. 2 p, 2 tab, 2 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Methods are given for correcting for organic substances interfering with analysis of mercury by absorption photometry. After the reading using the mercury photometer has been obtained, the cell is immediately transferred to a spectrophotometer, and a second reading of absorbance is made at 2537 angstroms. Mercury vapor has no appreciable absorbance under these conditions, since it absorbs only a narrow line at 2537 angstroms, which represents a small fraction of the total energy in the

wave lengths represented in the effective band. Interfering organic substances, on the other had, generally have rather broad absorption bands and produce a substantial absorbance both in the mercury photometer and as measured by the other instrument. Accordingly, the amount of extraneous absorbance at 2537 angstroms can be approximately measured and applied as a correction to the mercury reading. (See also W71-00167) (Knapp-USGS)
W71-00170

SENSITIVE SIMPLE MERCURY PHOTOMETER USING MERCURY RESONANCE LAMP AS A MONOCHROMATIC SOURCE,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
Clement Ling.
Analytical Chemistry, Vol 39, No 7, p 789-804, June 1967. 7 p, 4 fig, 2 tab, 13 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

A sensitive mercury photometer using a mercury resonance lamp as a source of sharp monochromatic resonance radiation is described. Parameters pertaining to sensitivity are discussed. Null method of increasing the sensitivity is also described. The potential application of the photometer in mercury isotopic analysis is suggested. Method for correcting nonatomic absorption is also proposed by means of which mercury may be analyzed in the presence of interfering substances. The instrument is compact enough to be portable. The detection limit (for 1% absorption) of the single beam system is 0.3 nanogram. (See also W71-00167) (Knapp-USGS)
W71-00171

PORTABLE ATOMIC ABSORPTION PHOTOMETER FOR DETERMINING NANOGRAM QUANTITIES OF MERCURY IN THE PRESENCE OF INTERFERING SUBSTANCES,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
Clement Ling.
Analytical Chemistry, Vol 40, No 12, p 1876-1878, October 1968. 3 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

A sensitive mercury photometer using a mercury resonance lamp as a source of sharp monochromatic resonance radiation is described. Parameters pertaining to sensitivity are discussed. Null method of increasing the sensitivity is also described. The potential application of the photometer in mercury isotopic analysis is suggested. Method for correcting nonatomic absorption is also proposed by means of which mercury may be analyzed in the presence of interfering substances. The instrument is compact enough to be portable. The detection limit (for 1% absorption) of the single beam system is 0.3 nanogram. (See also W71-00167) (Knapp-USGS)
W71-00172

THE USE OF AUTOMATED TITRIMETRY FOR ANALYSES OF NATURAL WATER,
Geological Survey, Denver, Colo.; and Geological Survey, Oklahoma City, Okla.
For primary bibliographic entry see Field 02K.
W71-00183

AUTOMATED POTENTIOMETRIC DETERMINATION OF CHLORIDE IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W71-00184

BIOCHEMICAL-OXYGEN-DEMAND, DISSOLVED-OXYGEN, SELECTED-NUTRIENTS, AND PESTICIDE RECORDS OF TEXAS SURFACE WATERS, 1969 WATER YEAR,
Geological Survey, Austin, Tex.
Jean A. Schulze, Alton J. Dupuy, and Douglas B. Manigold.
Texas Water Development Board Report 120, September 1970. 22 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Sampling, *Surface waters, *Texas, *Biochemical oxygen demand, *Dissolved oxygen, Nutrients, Pesticide residues, Water pollution sources, Water analysis, Water quality, Data collections.
Identifiers: Water quality records (Tex).

A network of daily and periodic chemical-quality stations on streams in Texas is operated by the U.S. Geological Survey in cooperation with the Texas Water Development Board and with other State, Federal, and local agencies. Analyses of water from this network include the principal inorganic constituents and related properties. BOD (biochemical oxygen demand), dissolved oxygen, and selected nutrients and pesticides are also determined at strategically located sites on most of the principal streams. Records of these periodic determinations were compiled through September 1968. (Knapp-USGS)
W71-00202

THE STATUS OF THERMAL DISCHARGES ON THE PACIFIC COAST,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
Wheeler J. North, and James R. Adams.
Chesapeake Science, Vol 10, No 3 and 4, p 139-144, Sept-Dec 1969. 2 fig, 3 tab.

Descriptors: *Thermal pollution, Thermal powerplants, Cooling water, Temperature, Regression analysis, Stratification, Water pollution sources, California, *Tidal waters.
Identifiers: Thermal discharge.

Thermal power stations that discharge waste heat from cooling water into tidal areas of California represent 85% or 16,982 megawatts (MW) of the total state thermal power capacity in 1969. The generation on tidal areas in Oregon is 169.5 MW, and in Washington is 77.9 MW. The surface area influenced in 35 measurements at 9 power station discharges was used to calculate a regression equation in which generation in MW was equated to surface area raised above normal temperature in acres. The linear regression for areas raised 2F above normal was Y — 104.422 .. .0902011 X, while the equation for areas raised 10F above normal was Y — 2.77812 .. .0126561 X. If all thermal stations in California were operated at maximum capacity, a total of 5.86 square miles of surface water would be raised 2F above normal, and 0.41 square miles would be raised 10F above normal, according to the regression equations. California has 400 square miles of bays and estuaries into which power stations discharge and a shoreline of 1205 miles. The average load factor (ratio of actual operating load to total capacity) at California tidal stations was 56% in 1966. (Upadhyaya-Vanderbilt)
W71-00242

THE DIURNAL CURVE IN ESTIMATES OF PRIMARY PRODUCTIVITY,
Federal Water Pollution Control Administration, Alameda, Calif. Southwest Region.
Charles M. Seeley.
Chesapeake Science, Vol 10, No 3 and 4, p 322-326, Sept-Dec 1969. 1 fig, 24 ref.

Descriptors: *Primary productivity, *Dissolved oxygen, Respiration, Photosynthesis, Water pollution effects.
Identifiers: *Diurnal curve, Saturation deficit, Diffusion coefficient, Aquatic system.

Changes in dissolved oxygen which occur in an aquatic system over a period of time are normally the result of: Photosynthetic production by aquatic plants within the water mass, respiration of aquatic plants, animals and bacteria, diffusion of oxygen into or out of the water, and advective gain or losses due to displacement of a water mass. Two principal approaches of the procedure are available to the investigator, the single-station method and the upstream-downstream method. The single-station method is described in this paper. Replicate sample for dissolved oxygen (mg/l) and water temperatures (C) are taken at intervals of three hours or less over a 24 hour period. Dissolved oxygen concentration and temperature data are plotted. Oxygen saturation values are determined and are graphed. An oxygen rate of change curve is constructed. Two points in time, the first shortly before sunrise and the second shortly after sunset (qm and qe) are chosen. The diffusion coefficient per volume, k, is calculated as k — 100 (qm - qe/Sm - Se) where qm and qe are the rate of change and Sm and Se are the percentage saturation deficit, before and after sunrise, respectively. Steps for obtaining the corrected rate-of-change curve, respiration rate and gross community photosynthesis are also described. (Upadhyaya-Vanderbilt)
W71-00252

EVALUATION OF CULTURE MEDIA FOR THE ISOLATION OF SALMONELLAE FROM FECES,
Iowa State Univ., Ames. Dept. of Veterinary Microbiology and Preventative Medicine.
R. M. Sharma, and R. A. Packer.
Journal of Applied Microbiology, Vol 18, No 4, p 589-595, 1969. 6 tab, 25 ref.

Descriptors: *Salmonella, *Farm wastes, *Cultures, Cattle, Hogs, *Isolation.
Identifiers: Brilliant Green MacConkey Broth, Tetrathionate Broth, Selenite Broth.

A study conducted on 300 fecal samples from a cow and a pig, each artificially contaminated with approximately four Salmonella organisms revealed that, of the three enrichment broths used in conjunction with the three selective media, the maximum number of isolations were obtained with Brilliant Green MacConkey broth (BGMB), followed by those obtained with tetrathionate (TTB), and the least with selenite broth. The combination of BGMB with Brilliant Green neutral red-lactose agar (BGNRLA), and TTB with desoxycholate citrate agar (DCA) gave an equal number of isolations. Of the three selective media used in conjunction with the three enrichment broths, the maximum number of recoveries were obtained on BGNRLA, followed by those on DCA, and least number of isolations on bismuth sulfite agar (BSA). The combination of selenite F broth-BSA appeared to be somewhat inhibitory for the growth of Salmonella organisms. Of the two selective media combinations, the DCA-BGNRLA combination yielded the highest number of isolations. The use of all three selective media gave still better results. (Miner-Iowa State)
W71-00325

IDENTIFICATION AND EXCRETION OF ESTROGEN IN URINE DURING THE ESTROUS CYCLE OF THE EWE,
Purdue Univ., Lafayette, Ind. Dept. of Animal Sciences.
E. D. Plotka, and R. E. Erb.
Journal of Animal Science, Vol 29, No 6, p 934-939, 1969. 2 fig, 1 tab, 27 ref.

Descriptors: Farm wastes, *Sheep, *Urine, Organic compounds, *Chromatography.
Identifiers: Estrone, *Estrogen, Pregnant ewes.

Estrone was identified in urine of the non-pregnant ewe by comparing its behavior to crystalline standard estrone and by its failure to separate from added 14C-estrone through solvent partitioning, paper chromatography, successive thin-layer chromatography in different systems, gas-chromotography, (GLC) on three columns, derivative forma-

tion and chromatography of the derivatives. The highest average rate of excretion of estrone and estradiol occurred during estrus averaging 394 and 479 ug./24 hr. as compared to the lowest rates of 20 and 17 ug./hr., respectively, the second day after estrus. Expressing excretion rate as ng/mg. of urinary creatine was highly correlated (r-0.97-0.98) to total excretion based on total collection of urine for 24 hours. (Miner-Iowa State)
W71-00330

A RAPID AND SIMPLE METHOD FOR THE DETECTION AND ISOLATION OF SALMONELLA FROM MIXED CULTURES AND POULTRY PRODUCTS,
Iowa State Univ., Ames. Dept. of Food Technology.
Daniel Y. C. Fung, and Allen A. Kraft.
Poultry Science, Vol 49, No 1, p 46-54, 1970. 1 fig, 7 tab, 7 ref.

Descriptors: *Isolation, *Salmonella, *Poultry, *Cultures, Farm wastes.
Identifiers: Poultry products, Motility flask, Concentrations, Strains.

This report deals with results obtained using a new rapid method of Salmonellae detection and isolation in mixed cultures, turkey and chicken products, and whole eggs. The paper describes a simple system, combining biochemical and physical properties of Salmonella, which can detect small numbers of Salmonella in the presence of large numbers of competitive organisms. Motility multilayered agar flasks were used in the test. Typical complete Salmonella reactions were obtained in the control flask as early as 17-36 hours of incubation, as compared with 48-96 hours by conventional methods. This system has the potential as a simple and rapid method for large scale screening test for Salmonellae in a variety of commercial food products. (White-Iowa State Univ)
W71-00336

STREAM SURVEYS PINPOINT POLLUTION,
Canadian Industries Ltd., New Toronto (Ontario).
Norman E. Cooke.
Industrial Water Engineering, Vol 7, No 9, p 31-33, September 1970. 3 p, 4 fig, 4 ref.

Descriptors: *Water pollution control, *Monitoring, *Bioindicators, Waste disposal, Water pollution sources, Sampling, Statistical methods, Surveys, Data collections, Bottom sediments, Aquatic habitats, Industrial wastes.
Identifiers: Water pollution monitoring.

Basing quality control charts on the responses of simple mud-dwelling animals to the toxic substances enables detection of incipient contamination in receiving waterways, both polluted and unpolluted. To detect and recognize a meaningful signal in the presence of a large amount of noise is always a difficult task. Basing effluent quality control charts on the differences in the number of animals found at locations upstream and downstream from a plant outfall permits one to detect a significant change caused by material discharged through the outfall despite very large fluctuations in the number of animals caused by random discharges of polluting materials upstream. (Knapp-USGS)
W71-00348

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
Yiu-Kee Chau, and Hirohumi Saitoh.
Environmental Science and Technology, Vol 4, No 10, p 839-841, October 1970. 3 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Trace elements, *Heavy metals, *Pollutant identification, *Water pollution sources, *Lakes, Chemical analysis, Analytical techniques, Water analysis, Water chemistry, Poisons, Industrial wastes, Laboratory tests, Spectrophotometry.
Identifiers: Mercury.

A simple and sensitive method for the determination of submicrogram amounts of mercury in lake water was developed by combination of concentration by dithizone extraction and gas-phase atomic absorption. The mercury was first extracted by dithizone, back extracted by hydrochloric acid, and then converted to vapor by a reduction-aeration reaction. Hg, Hg (I), Hg (II), and some organomercuric compounds were extracted by the present procedure. A sensitivity of 0.008 micrograms per liter (0.008 ppb) was achieved for water analysis. Standard deviations of 0.0087 and 0.0042 were found for lake water samples containing 0.478 and 0.048 micrograms per liter of Hg, respectively. (Knapp-USGS)
W71-00355

GEOTHERMAL WASTES AND THE WATER RESOURCES OF THE SALTON SEA AREA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 02K.
W71-00356

HUMIC SUBSTANCES: FULVIC ACID-DIALKYL PHTHALATE COMPLEXES AND THEIR ROLE IN POLLUTION,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
For primary bibliographic entry see Field 05B.
W71-00377

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.
For primary bibliographic entry see Field 05B.
W71-00397

RAPID PROCEDURES TO MONITOR WATER FOR POTABILITY,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
Arnold R. Slonim.
Available from NTIS as AD-705 445, $3.00 in paper copy, $0.95 in microfiche. Aerospace Medicine, Vol. 39, No. 11, November 1968, p 1182-1189.
Identifiers: *Water supplies, Monitors, *Water pollution, Measurement, Accelerated testing, infrared equipment, Smell, Taste, Colors, pH, Particles, Organic compounds, Microbiology, Radiological contamination, Potable water, Turbidity.

The latest developments in methodology for monitoring aerospace water supplies for potability are described. Analytical techniques are emphasized that meet some of the following criteria: reproducibility, sensitivity of measurement, rapidity of analysis, instrumentational capability, and potential for aerospace monitoring. The leading instrumentational methods are the two recent combustion/infrared techniques for measuring organic pollution, one for total organic carbon and the other for chemical oxygen demand, and bioluminescence for determining microbiological contamination of water samples. Other potentially sound methods as well as future trends for aerospace applications are discussed.
W71-00455

AUTOMATED POTENTIOMETRIC TECHNIQUES FOR THE ON-SITE MONITORING OF ION CONCENTRATIONS IN WATER,
Missouri Univ., Columbia. Dept. of Chemistry.
Stanley E. Manahan.
Available from NTIS as PB-195 167, $3.00 in paper copy, $0.95 in microfiche. OWRR Completion Report, 1970. OWRR Project A-024-MO (11).

Descriptors: *Analytical techniques, *Water analysis, *Nitrates, *Electrodes, Ions, Fluorides, Algae, Volumetric analysis, Water chemistry.
Identifiers: Ion-selective electrodes, Standard addition, Potentiometry, Interfering ions.

The characteristics of the nitrate electrode - fluoride electrode cell without liquid junction were investigated for applicability to nitrate ion analysis. In addition to enabling accurate nitrate analysis, the cell was found to be useful for examining the effects of interfering ions. An attempt was made to use the nitrate electrode in following nitrate ion uptake by algal cultures. The algae interfere to a certain extent with the electrode response. Using knowledge gained from research under this grant a potentiometric nitrate analysis capability has been set up at the University of Missouri Environmental Trace Substances Laboratory.
W71-00474

TREATMENT OF ACID MINE DRAINAGE OF REVERSE OSMOSIS.
Rex Chainbelt, Inc., Milwaukee, Wis.

Available from NTIS as PB-195 200, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.55. I67.13/4:14010 DYK 03/70. Water Pollution Control Research Series 14010 DYK 03/70, March 1970. 35 p, 12 tab, 11 fig, 15 ref, append. FWPCA Project 14010 DYK.

Descriptors: *Reverse osmosis, *Acid mine water, *Mine drainage, *Demineralization, Waste water treatment, Osmosis, Pennsylvania, Dissolved solides, Iron, Manganese.
Identifiers: Shickskinney (Pennsylvania).

This report documents a study on the treatment of acid mine drainage by reverse osmosis. The objective of the study was to determine the feasibility of utilizing reverse osmosis to abate pollution due to acid mine drainage, and produce a water which could be used by industry or as a municipal water supply. A test site in Shickshinny, Pennsylvania was selected as a source of acid mine water. A sample of this water was tested in a laboratory reverse osmosis unit to determine the design parameters for a 10,000 gallon per day demonstration unit. This unit was operated for a period of 35 days on acid mine drainage as received from the Mocanaqua discharge near Shickshinny. Operation during this period was continuous, i.e., 24 hours per day. Daily samples of feed water, product water, and waste concentrate were analyzed to determine the effectiveness of the demonstration unit. The results obtained during the demonstration period indicated that the reverse osmosis process has potential application in acid mine drainage treatment. A high quality water was produced which was suitable for use by industries or municipalities with a minimum of additional treatment. There are, however, operational problems which must be solved prior to utilzing reverse osmosis on a large scale. These include maintenance of high permeation rates through the membrane by reducing membrane fouling and determination of the optimum flow sheet for an acid mine treatment system utilizing reverse osmosis. It is recommended that: (1) The mechanisms and method of reducing iron fouling of reverse osmosis membranes be evaluated in the laboratory using synthetic acid mine water; (2) The optimum flow sheet for treating acid mine drainage by reverse osmosis be determined by laboratory evaluation of synthetic acid mine water; and (3) The laboratory data be confirmed by a field evaluation period.
W71-00477

5B. Sources of Pollution

A STUDY OF GROUNDWATER POLLUTION BY SALT.

Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-34. 13 p.

Descriptors: *Water pollution sources, *Mine wastes, *Saline water intrusion, *Aquifers, *Alluvial channels, Salts, Saline water.
Identifiers: France, Rhine Valley, Alsace.

Pollution by brines of a groundwater in the Eastern part of France is described. The origin and intensity of the phenomenon, the measurement program, and the theoretical schemes which have been used to analyze and to predict the development of the pollution are discussed. The study was limited to the Rhine's alluvial aquifer in Alsace, a province of northeastern France. Its area is over 5000 square kilometers and its thickness varies between 0 and more than 200 meters. The beds consist of highly permeable Quaternary alluvial deposits (permeability about 0.001 m/sec) lying on an Oligocene marl substratum which is, in places, also covered by a Pliocene stratum of sandy clay. An increase of the sodium chloride content of the groundwater has been noticed, and it is ascribed to the presence of important potash mine-workings in the southern part of the district. (Knapp-USGS)
W71-00001

EFFECTS OF DENSITY DIFFERENCES ON LATERAL MIXING IN OPEN-CHANNEL FLOWS,

California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
Edmund A. Prych.
California Institute of Technology, W M Keck Laboratory of Hydraulics and Water Resources Report No KH-R-21, May 1970. 225 p, 76 fig, 15 tab, 37 ref, append. FWQA Grants 16000 DGY and 16070 DGY.

Descriptors: *Mixing, *Turbulent flow, *Diffusion, *Dispersion, *Path of pollutants, Open channel flow, Estuaries, Streams, Streamflow, Stratified flow, Density, Density stratification, Model studies, Hydraulic models, Mathematical models, Turbulence.
Identifiers: Longitudinal dispersion, Lateral dispersion.

Lateral mixing of tracer fluids were studied in turbulent open-channel flows in which the tracer and ambient fluids have different densities. Longitudinal dispersion in flows with longitudinal density gradients were investigated also. Lateral mixing was studied in a laboratory flume by introducing fluid tracers at the ambient flow velocity continuously and uniformly across a fraction of the flume width and over the entire depth of the ambient flow. When there was a difference in density between the tracer and the ambient fluids, lateral mixing close to the source was enhanced by density-induced secondary flows; however, far downstream where the density gradients were small, lateral mixing rates were independent of the initial density difference. Normalized variance is a function of only three dimensionless numbers, which represent: (1) the x-coordinate, (2) the source width, and (3) the buoyancy flux from the source. Predicted longitudinal salinity distributions in an idealized laboratory estuary agree well with published data. (Knapp-USGS)
W71-00005

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,

Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W71-00020

CIRCULATION, EFFLUENT DIFFUSION, AND SEDIMENT TRANSPORT, MOUTH OF SOUTH PASS, MISSISSIPPI RIVER DELTA,

Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright.
Louisiana State University Coastal Studies Institute Technical Report No 84, June 30, 1970. 56 p, 24 fig, 6 tab, 91 ref. ONR Project No N R 388 002.

Descriptors: *Mississippi River, *Deltas, *Sediment transport, *Saline water intrusion, Water circulation, Currents (Water), Mixing, Disperison, Suspended load, Density stratification, Density currents, Bed load, Turbidity.
Identifiers: Mississippi River delta.

A study was conducted at the mouth of South Pass, Mississippi River, to ascertain the influence exerted by interaction between effluent and ambient fluids; tides; waves; winds; bottom topography and channel mouth geometry; regional coastal currents; horizontal and vertical density gradients; and hydrologic regime of the Mississippi River. Downstream flow within the pass, as well as efflux seaward of the mouth, was swiftest during ebbing tide. Salt-wedge circulation in the lower reaches of the pass was characterized by upstream flow at flooding tide and downstream flow at ebbing tide. Statistical analyses indicated that river stage, tide, sea state, and position relative to the distributary mouth bar exert a significant influence on vertical stratification and mixing seward of the mouth. Stratification was most pronounced during high river stage, flooding tide, calm seas, and along the effluent axis, and weakened progressively from the mouth to the bar crest. In the fluvial-marine interaction zone immediately seward of the mouth, the freshwater effluent spread laterally as a relatively discrete and homogeneous mass. Suspended-sediment concentration varied directly with river stage and inversely with temperature. (Knapp-USGS)
W71-00036

SATREN V HADER CO-OPERATIVE CHEESE FACTORY (ABATEMENT OF NUISANCE CAUSED BY DISCHARGE OF INDUSTRIAL WASTE).

For primary bibliographic entry see Field 06E.
W71-00087

EUTROPHIC EVALUATION OF A SMALL MULTI-LAND USE WATERSHED,

Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-00141

EFFECTS OF URBANIZATION ON THE QUALITY OF SELECTED STREAMS IN SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y.
Ellis Koch.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C189 -C192, 1970. 4 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Urbanization, *Water pollution sources, *New York, *Water quality, Streamflow, Surface waters, Runoff, Nitrates, Industrial wastes, Domestic wastes, Sewage disposal, Path of pollutants.
Identifiers: Long Island (NY), Nassau County (NY).

The water quality of the streams in southern Nassau County has diverged noticeably from natural conditions because of extensive urbanization. The quality of two streams in sparsely populated areas in Suffolk County was compared with the quality of three streams in moderately to densely populated parts of Nassau County. The estimated load of dissolved solids of all the southern Nassau County streams presently is about 10.5 tons per day greater than the estimated load under natural conditions. Furthermore, analysis of the data for certain constituents directly affected by man shows that the detergent content of the three streams in Nassau County ranges from County streams; the nitrate content is 14 times that of the Suffolk County streams; and the dissolved-solids content is about 3 to 4 times that of the Suffolk County streams. (Knapp-USGS)
W71-00175

USE OF CHANNEL SLOPE AND DISCHARGE TO DETERMINE REAERATION COEFFICIENTS FOR THE ELKHORN RIVER IN NEBRASKA,

Geological Survey, Lincoln, Nebr.
K. A. MacKichan, Neil G. Stuthmann, and Ray Bentall.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C193 - C197, 1970. 5 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Reaeration, *Streamflow, *Channel morphology, *Slopes, *Discharge (Water), Nebraska, Velocity, Turbulent flow, Biodegradation, Self-purification, Waste assimilative capacity, Dissolved oxygen, Frequency analysis.
Identifiers: Elkhorn River (Nebr).

The reaeration coefficient, k, of a stream at a given point can be computed from an empirical formula expressing k in terms of mean velocity and mean depth. As both velocity and depth vary with discharge and channel slope, k for a given stream obviously can be expressed equally well in terms of discharge and slope. An equation is presented whereby k for any point along the Elkhorn River in Nebraska can be computed, using channel-slope data, for minimum 7-day discharges having different recurrence intervals. (Knapp-USGS)
W71-00176

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,

Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 02F.
W71-00178

EFFECTS OF A CONCENTRATED ACID ON WATER CHEMISTRY AND WATER USE IN A PLEISTOCENE OUTWASH AQUIFER,

Geological Survey, Louisville, Ky. Water Resources Div.
Hayes F. Grubb.
Groundwater, Vol 8, No 5, p 4-7, September-October 1970. 4 p, 9 fig, 2 tab, 3 ref.

Descriptors: *Water pollution sources, *Industrial wastes, *Groundwater movement, *Recharge, *Surface-groundwater relationships, Malenclaves, Path of pollutants, Acids, Leaching, Chlorides, Glacial drift, Aquifers, Ohio River, Kentucky.
Identifiers: Hydrochloric acid.

A break in a waste-discharge line at the same time as a 49-foot rise in stage of the Ohio River in March 1967 allowed hydrochloric acid to enter the Pleistocene outwash aquifer used by a Kentucky industry. Chloride concentrations in excess of 30,000 mg/liter were observed in the water discharged from the industrial well nearest the break in the waste-discharge line. By March 1968, the well nearest the acid source was abandoned, the remaining two wells near the river were used in a supplemental capacity and a fourth well 1,500 feet from the river plus a new well were the primary water sources. Fluctuations of chlorides in an industrial well near the river for a 16-month period indicate a persistent body of highly mineralized water near the acid source. Movement of this water

body appears to be regulated at low river stages by the inclined surface of the New Albany Shale bedrock. (Knapp-USGS)
W71-00194

A STUDY OF THE DISPERSION AND FLUSHING OF WATER-BORNE MATERIALS IN THE NORTHWEST BRANCH OF BALTIMORE HARBOR, AND THE RELATIONSHIP BETWEEN THESE PHYSICAL PROCESSES AND THE WATER QUALITY OF THE INNER HARBOR,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Robert E. Wilson.
Johns Hopkins University Chesapeake Bay Institute Technical Report 64, Mar 1970. 101 p, 38 fig, 20 ref, 5 append.

Descriptors: *Tracers, *Dye releases, *Mathematical models, *Path of pollutants, Model studies, Waste assimilative capacity, Currents (Water), Diffusion, Mixing, Water circulation, Advection, Computer programs.
Identifiers: Baltimore Harbor (Md).

Based on this model, circulation in the Branch may be classified into 4 distinct types according to the direction of net volume flow. Circulation within the Branch is very transient and changes rapidly from one type to another. Modal values for volume flow and diffusive exchange may be determined for each of the basic circulation types. (Knapp-USGS)
W71-00200

BIOCHEMICAL-OXYGEN-DEMAND, DISSOLVED-OXYGEN, SELECTED-NUTRIENTS, AND PESTICIDE RECORDS OF TEXAS SURFACE WATERS, 1969 WATER YEAR,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 05A.
W71-00202

SANITARY BIOLOGICAL CONDITIONS, PROCESSES OF SELF-PURIFICATION AND CONTENT OF TRACE ELEMENTS IN THE WATERS OF THE RIVERS OF THE SHEKI-ZAKATALY ZONE OF AZERBAYDZHAN,
K. F. Akhundov, T. V. Grekalova, N. I. Karayeva, and S. M. Tenengol'ts.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 2, 1969. Hydrobiological Journal, Vol 5, No 2, p 29-32, 1969. 4 p, 3 tab, 4 ref.

Descriptors: *Self-purification, *Reaeration, *Rivers, *Path of pollutants, Industrial wastes, Oxygen demand, Oxygen sag, Waste assimilative capacity.
Identifiers: *USSR, Azerbaydzhan.

Hydrochemical and microbiological investigations were made of the rivers of the Sheki Zakataly zone of Azerbaydzhan. The principal rivers are polluted by industrial wastes, but they are capable of self purification. The total quantity of microbes is as much as 12 million colonies/milliliter. Analysis of the chemical composition of the waters of the rivers investigated places them in the bicarbonate class. The waters of these rivers are either weakly or moderately mineralized. The high intensity of self-purification in mountain rivers is associated with good aeration due to mixing. Its magnitude does not depend upon the turbulence of the current: in the case of mountain currents with a rapid flow self-purification is equal (at 15 deg C) to 0.74 as compared with the case of lowland rivers in which it is about 0.18. (Knapp-USGS)
W71-00220

SEASONAL DYNAMICS OF THE REDUCING SUGAR CONTENT OF WATER IN THE KIEV RESERVOIR AND INFLOWING RIVERS,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
G. A. Yenaki.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 3, 1969. Hydrobiological Journal, Vol 5, No 3, p 47-50, 1969. 4 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Reservoirs, *Eutrophication, *Carbohydrates, *Nutrients, *Biodegradation, Algae, Bacteria, Aquatic microorganisms, Sampling, Water analysis, Water quality, Pollutant identification.
Identifiers: Kiev Reservoir (USSR).

Carbohydrate-like compounds in natural waters play an important role in processes which occur within reservoirs and in particular in processes of formation and transformation of organic substances in natural waters. Monthly determinations were made in 1965 and 1966 of the reducing sugar content of water in the Kiev reservoir and the rivers flowing into it--the Dnieper, Pripyat', and Teterev. Determination of sugars was conducted on filtered water by a spectrophotometrical method. The high content of reducing sugars in water of the Kiev reservoir is one of the main factors responsible for the intensive development of microorganisms, the intensification of biochemical processes, and the transformation of biogenic elements. This condition involves an increase in the number of planktonic organisms and the occurrence of 'blooming' of the water. The content of reducing sugars in water of the Kiev reservoir in 1965 and 1966 varied from 0.26-1.33 mg/liter, and in the rivers flowing into the reservoir this value was equivalent to 0.17-1.63 mg/liter. The glucose carbon was equivalent to 0.7-6.7% and 0.9-4.1% of the total organic carbon, respectively. The maximum quantity of sugars was found in spring and summer, and the minimum quantity was found in winter. The increase in content of reducing sugars in the water of the Kiev reservoir was one of the factors which caused 'blooming' of the water in the spring-autumn period of 1966. (Knapp-USGS)
W71-00221

MICROBIAL OXIDATION OF SOME PETROLEUM PRODUCTS IN WATERS OF THE DANUBE RIVER,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
N. A. Gavrishova.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 3, 1969. Hydrobiological Journal, Vol 5, No 3, p 29-34, 1969. 6 p, 2 fig, 3 tab, 21 ref.

Descriptors: *Oily water, *Biodegradation, *Bacteria, Aquatic microorganisms, Oxidation, Rivers, Self-purification, Oxygen demand, Biochemical oxygen demand, Path of pollutants.
Identifiers: Danube River (USSR).

Bacteria capable of oxidizing machine oils are widely found in waters of the Soviet sector of the Danube. Their number decreases sharply only during the winter period, when there is no navigation and the water temperature is low. The number of bacteria-oxidizing petroleum products, and also their ratio to the number of heterotrophic bacteria, characterize the waters of the Danube as being contaminated to a considerable extent. Bacteria consumed up to 1-6 mg oxygen per liter of water during 5 days for the oxidation of petroleum products. (Knapp-USGS)
W71-00222

THE ROLE OF HIGHER WATER PLANTS IN THE SELF-PURIFICATION OF OIL-POLLUTED RIVERS,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
N. V. Morozov, R. B. Petrova, and G. N. Petrov.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 4, 1969. Hydrobiological Journal, Vol 5, No 4, p 37-42, 1969. 6 p, 11 ref.

Descriptors: *Oily water, *Surface waters, *Aquatic plants, *Self-purification, Laboratory tests, Water pollution, Foreign projects.
Identifiers: Cattail, Common reed, Bulrush, Blunt-leaved pondweed, Canadian pondweed.

The role of higher water plants in the disposal of an oil film on water is demonstrated. The experiments were conducted in glass vessels having a capacity of 15-20 liters and were placed in the open air. The plants used were those most common in bodies of water in the Middle Volga region, USSR. The oil film was rapidly destroyed by the microorganisms in the presence of the plants and as this happened a small quantity of brown moss-like projections formed on the lower surface and were gradually destroyed, partly settling or disappearing. In the course of the experiment, which extended through the phases of bud formation, flowering, and fruiting, almost 90% of the surface of the water in the vessels with an oil concentration of 1 g/liter was cleaned of the film: by the 3rd - 5th day with greater reedmace, the 5th - 6th day with bulrush, the 5th - 7th day with blunt-leaved pondweed, the 4th - 8th day with reed, and the 5th - 9th day with lesser reedmace. In the control vessels without plants a similar phenomenon was noted on the 28th - 32nd day. The addition of petroleum has a positive effect on the development of plants which grow above and below the water and on Canadian pondweed. A concentration of 100 g/liter kills the plants in 3-10 days and a concentration of 10 g/liter kills them over a longer period. (Knapp-USGS)
W71-00223

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
Hugo B. Fischer.
University of California Water Resources Center contribution No. 132, March 1970. p 143, 16 fig, 9 tab, 21 ref. NSF Grant GK-3210.

Descriptors: *Pollutants, *Estuaries, *Computer programs, *Dispersion, Friction, Turbulence, Hydraulics, Mixing, Winds, Forecasting, Currents (Water), Water pollution sources, Water pollution control, *Model studies.
Identifiers: *Numerical models, Tidal velocities, Transport, Geometry two-dimensional.

A model for predicting pollutant distributions in estuaries is presented. The numerical model is entirely predictive, in-that it models both the hydraulics and pollutant transport without requiring field measurement of artificial coefficients. It can be used to study in advance of construction the effect of dredging, dike-building, or channel realignment, or the effect on an existing estuary of a new source of pollutant. An example of the use of the programs has been described. The importance of wind-induced circulation in the bay is shown by comparison of a run with wind and one without. Only the one-dimensional pollutant transport program has received field verification; the two-dimensional pollutant program has not been verified at all. (Upadhyaya-Vanderbilt)
W71-00231

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
D. W. Mackay, and J. I. Waddington.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 2, 1970. Preprint, Paper III-7, 6 p, 4 fig.

Descriptors: *Estuaries, *Dissolved oxygen, Salinity, Tides, Temperature, Biochemical oxygen demand, Sampling, *Dissolved oxygen, Water pollution sources, Water pollution control.
Identifiers: Retention time.

Some methods adopted by the Clyde River Purification to investigate the system are outlined, and one case for which it has been possible to look back on the accuracy of prediction is described. The main shipping channel of the Clyde Estuary receives the drainage from a heavily industrialized

region with population of 2.4 million. The circulation of water in the estuary is extremely complex. During dry spells, the dissolved oxygen content of the upper estuary falls to zero for a distance of up to 20 km. The dissolved oxygen levels in the Clyde Estuary vary directly with the fresh water input and inversely with the temperature. Equations were derived linking these parameters at each of 13 stations spaced at 3.2 km: intervals seawards from the head of the estuary. The salinity, for a range of five depths at each sampling station, has been measured. Flows are expressed as percentage exceedences. Retention time in the upper 32 km of the estuary varies between 2 and 20 days depending mainly upon fresh water input. The sum of the product of BOD and retention time gives an index of pollution producing the observed dissolved oxygen deficit. It was predicted that a reduction of 13% in the overall dissolved oxygen deficit would result from beginning operation of the new treatment plant. The reduction in the dissolved oxygen deficit is 11% overall and is in satisfactory agreement with the prediction made. (Upadhyaya-Vanderbilt)
W71-00236

THE STATUS OF THERMAL DISCHARGES ON THE PACIFIC COAST,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
For primary bibliographic entry see Field 05A.
W71-00242

THE STATUS OF THERMAL DISCHARGES EAST OF THE MISSISSIPPI RIVER,
Bronx Community Coll., N.Y. Nursing Center.
Emanuel V. Sorge.
Chesapeake Science, Vol 10, No 3 and 4, p 131-138, Sept-Dec 1969. 6 tab.

Descriptors: *Thermal pollution, *Powerplants, Efficiencies, Temperature ecosystems, Water pollution sources.
Identifiers: *Thermal discharge.

At present 86 fossil fueled plants are discharging their thermal effluents into the waters abounding the East Coast. By 1980 power needs will require 200 billion gallons of water per day or approximately one sixth of our annual nationwide run off and nearly 32% of all power stations will be adjacent to various estuaries. By the year 2000, utility companies will be utilizing almost twice the national freshwater runoff and a lifetime supply of either 10 million tons of uranium or 100,000 million tons of coal. Advanced nuclear reactors, highly more efficient, will be needed to ensure the safety of our waterways. Fossil-fueled plants are approximately 40 percent efficient whereas nuclear fueled plants tend to be less efficient, at 33 percent. A 1000 MW nuclear fueled plant will utilize nearly 1.3 billion gallons of water per day. Though one plant may raise the temperature only a few degrees within a limited area from the discharge canal, an accumulation of heated effluent from multiple units could prove disastrous for many miles, especially during critical periods of the year. Tables are given listing the nuclear plants in operation, plants for which equipment has been ordered and thermal plants in East Coast and Central U.S. (Upadhyaya-Vanderbilt)
W71-00255

GASES AND ODORS FROM STORED SWINE WASTES,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Arthur J. Muehling.
Journal of Animal Science, Vol 30, No 4, p 526-531, April 1970. 18 ref.

Descriptors: *Farm wastes, Ammonia, Manure, *Gases, Odor, Methane, Carbon dioxide, Hydrogen sulfide, *Hogs.
Identifiers: Swine confinement, *Manure odors, Storage pits.

One major problem arising from the storage, handling, treating and eventual utilization or disposal of hog wastes associated with confinement hog systems is the inevitable presence of gases and odors. The most important gases generated in a hog confinement unit are thought to be carbon dioxide, ammonia, hydrogen sulfide, methane and a large group of trace compounds such as amines, mercaptans, and skatoles. Under normal conditions in an adequately ventilated confinement unit no noxious gas reaches lethal or even harmful concentrations for pits or humans. Critically dangerous conditions exist when the oxygen content of the air diminishes from the normal 21 to 10% or less. It is only under special conditions such as during a ventilation failure, or during rigorous agitation of the manure pit that dangerous levels are reached. It may be possible to apply the industrial methods of treating odors; namely, dilution, absorption, adsorption, masking, counteraction and burning to the control or odors from stored manure. (Miner-Iowa State)
W71-00326

THE EFFECT OF HUMIDITY AND FLOORING TYPE ON THE MOISTURE CONTENT OF BROILER EXCREMENTS,
West Virginia Univ., Morgantown. Dept. of Animal Industries and Veterinary Science.
R. A. Peterson, M. A. Hellickson, W. D. Wagner, and A. D. Longhouse.
Poultry Science, Vol 49, No 2, p 439-443, March 1970. 1 fig, 2 tab, 2 ref.

Descriptors: *Farm wastes, Livestock, *Poultry, *Manure, Humidity, Air environment.
Identifiers: Broilers, Moisture content, *Flooring systems.

Experiments were conducted in part to determine the effect of humidity and flooring type on the moisture content of excreta from broilers. The experiments using broiler type chicks fed a high energy ration were conducted in four controlled 1.8 x 2.4 x 2.4 m environmental chambers. Relative humidity was measured and maintained. The following types were used, (1) 2.5 cm by 2.5 cm. welded wire (2) 1.3 cm. by 2.5 cm. welded wire and (3) 1.9 cm. flat wooden slats spaced 0.6 cm. apart. The average moisture content was significantly less in excreta collected under 1.9 cm. flat slats than collected beneath either 2.5 x 2.5 cm. or 1.3 x 2.5 welded wire floors. (Miner-Iowa State University)
W71-00327

EFFECT OF STRESS ON SWINE: HEAT AND COLD EXPOSURE AND STARVATION ON VANILMANDELIC ACID OUTPUT IN THE URINE,
Guelph Univ. (Ontario). Dept. of Nutrition.
M. P. Stefanovic, H. S. Bayley, and S. J. Slinger.
Journal of Animal Science, Vol 30, No 3, p 378-381, 1970. 1 fig, 2 tab, 12 ref.

Descriptors: *Hogs, Air temperature, *Urine, Amino acids, *Farm wastes.
Identifiers: Vanilmandelic acid output, Starvation, Metabolic response.

Tests were performed on 3 Yorkshire pigs in which they were subjected to normal conditions, extreme temperatures of 5 and 33C, and finally starved for 10 days at 20C. The urinary excretion of 3-methoxy - 4-hydroxymandelic acid (VMA) was measured when the pigs were housed in cages maintained at a room temperature of 20C. Observations of the VMA content was also made at times the pigs were under the stress conditions. The pigs increased in weight from 8 to 30 kg. during the 70 day experiment. Under normal temperature they excreted 10 mg of VMA per 24 hours. This increased to between 20 and 30 mg when the pigs were exposed to the low temperature. Exposure to the high temperature resulted in an excretion of 20 mg per day, but starvation caused a rapid decline to 3 mg per day. The excretion returned to normal values very rapidly when the animals were refed. These observations are discussed in relation to those made by other authors with other species on the effects of stress on the release and metabolism of catecholamines and their excretion in the urine, and it is suggested that the urinary output of VMA offers a convenient method of measuring physiological response to stress in the pigs. (White-Iowa State)
W71-00335

BACTERIAL CONTAMINATION IN POULTRY HOUSES AND ITS RELATIONSHIP TO EGG HATCHABILITY,
Pennsylvania Univ., University Park. Dept. of Poultry Science.
C. L. Quarles, R. F. Gentry, and G. O. Bressler.
Poultry Science, Vol 49, No 1, p 60-66, 1970. 8 tab, 15 ref.

Descriptors: *Farm wastes, *Bacteria, *Poultry, *Fertility, Eggs.
Identifiers: *Egg contamination, Egg hatchability, Air sampler, Litter houses, Litter nests, Wire floors, Roll-away nest.

This study was designed to determine if there was any relationship among poultry house contamination, egg contamination and hatchability. A high density sloping wire floor system was compared with the conventional litter floor system. Rates of egg production and fertility were similar in both systems. Litter houses averaged 9 times as many bacteria per cubic foot of air as wire floor houses. An attempt was made to study the level and transmission of coliform type bacteria as related to type of house and nest used. Hatchability of eggs in wire flood pens was superior to eggs from litter floor pens. Fungal contamination of air was approximately the same for both systems. (White-Iowa State)
W71-00337

PROBABLE SOURCES OF SALMONELLAE ON A POULTRY FARM,
Punjab Agricultural Univ., Hissar (India). Dept. of Veterinary Bacteriology and Hygiene.
S. M. Goyal, and I. P. Singh.
British Veterinary Journal, Vol 126, No 4, p 180-184, 1970. 2 tab, 17 ref.

Descriptors: *Farm wastes, *Salmonella, *Poultry, *Farm, Domestic animals, Rodents, Reptiles.
Identifiers: Salmonellosis, Transmission, Cross-infection.

This study was undertaken to determine various sources of Salmonellae on a poultry farm. Pigs, sheep, and other domestic animals were checked, as well as rats, sparrows, birds, and wall lizards. Eight Salmonellae types were isolated from poultry, pigs, rats, wall lizards, and house sparrows. S. anatum was isolated from all these sources and S. stanley from rats and poultry, indicating the possibility of cross-infection due to multiple foci of Salmonella infections. Rodents, free-flying birds and lizards were considered as important sources of Salmonellae. (White-Iowa State)
W71-00338

ATTRACTION OF COPROPHAGOUS BEETLES TO FECES OF VARIOUS ANIMALS,
Georgia Coastal Plain Experiment Station, Tifton.
G. Truman Fincher, T. Bonner Stewart, and Robert Davis.
The Journal of Parasitology, Vol 56, No 2, April 1970, p 378-383. 2 tab, 20 ref.

Descriptors: *Farm wastes, *Insects, *Habitats, Animal, Intermediate hosts.
Identifiers: *Beetle species, Pit traps, Feces, Woodland habitat, Swine pasture, Dairy pasture.

Beetles were attracted to pit traps baited with the feces of one of 12 different animals in 3 habitats. Comparison of the 3 habitats showed marked differences in beetle fauna. Most dung beetles were captured in traps baited with swine feces. Swine and opossum feces attracted 57.7% of all beetles

captured and 74.8% of the Phanaeus species which are the major intermediate hosts of swine spirurids in southern Georgia. Captured beetles comprised 12 genera with more than 18 species. (White-Iowa State)
W71-00340

STREAM SURVEYS PINPOINT POLLUTION,
Canadian Industries Ltd., New Toronto (Ontario).
For primary bibliographic entry see Field 05A.
W71-00348

LOVEJOY V TOWN OF DARIEN (DESTRUCTION OF COASTAL OYSTER BEDS BY MUNICIPAL CONSTRUCTION OF SEWAGE PIPELINES).
For primary bibliographic entry see Field 06E.
W71-00351

PHYSICAL DATA OF POTOMAC RIVER TIDAL SYSTEM INCLUDING MATHEMATICAL MODEL SEGMENTATION,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05G.
W71-00375

HUMIC SUBSTANCES: FULVIC ACID-DIALKYL PHTHALATE COMPLEXES AND THEIR ROLE IN POLLUTION,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
Gunnar Ogner, and Morris Schnitzer.
Science, Vol 170, No 3955, p 317-318, October 16, 1970. 2 p, 17 ref.

Descriptors: *Humic acids, *Soil physical properties, *Path of pollutants, *Fulvic acids, Soil contamination, Toxins, Water chemistry, Pollutants, Water pollution sources, Aquatic environment, Organic compounds, Lakes.
Identifiers: Dialkyl phthalate complexes.

The isolation and identification of small amounts of dialkyl phthalates in fulvic acid is discussed and suggestions are made as to the possible role of fulvic acid in pollution. Fulvic acid is a water-soluble humic material with relatively low molecular weight that occurs widely in soils and waters. It can interact with lyophobic organic compounds such as alkanes, fatty acids, and dialkyl phthalates, some of which may be toxic pollutants. Fulvic acid may thus mediate the mobilization, transport, and immobilization of such substances and contribute to the pollution of the aquatic environment. (Lang-USGS)
W71-00377

SULFUR: SIMULATED LONG-RANGE TRANSPORT IN THE ATMOSPHERE,
Battelle Memorial Inst., Seattle, Wash.
Howard Reiguam.
Science, Vol 170, No 3955, p 318-320, October 16, 1970. 3 p, 3 fig, 10 ref.

Descriptors: *Model studies, *Air pollution, *Sulfur, Numerical analysis, Winds, Air environment, Weather modification, Methodology.
Identifiers: *Continental air pollution, Europe, Atmospheric transport, Particulates.

The question of whether or not air pollutants are transported on a continental scale is examined by numerical simulation. A simple atmospheric transport and accumulation model, together with mean wind data and an estimated source distribution in Western Europe, were used. Results of the study suggest that Great Britain and Central Europe contribute to observed concentrations of sulfur in Northern Europe. Pollutants are assumed to be contained in the atmospheric belt within 3 km of earth surface. Mean winter concentration of total sulfur in mg per cu m are plotted on three maps showing (1) sulfur emissions in all Western European countries, (2) all of Europe except the United Kingdom, and (3) sulfur emissions in only the United Kingdom. No natural sources are included nor are any sulfur removal mechanisms considered. The results suggest that in dry weather periods, when major removal devices are not in use, sulfur may be carried long distances. (Lang-USGS)
W71-00385

AIR POLLUTION SURVEILLANCE SYSTEMS,
National Air Pollution Control Administration, Cincinnati, Ohio. Bureau of Criteria and Standards.
George B. Morgan, Guntis Ozolins, and Elbert C. Tabor.
Science, Vol 170, No 3955, p 289-296, October 16, 1970. 8 p, 3 fig, 8 tab, 17 ref.

Descriptors: *Air pollution, *Aerosols, *Gases, *Surveys, *Instrumentation, Methodology, Remote sensing, Data collections, Atmosphere, Fallout, Air pollution effects, Pollutant identification, Urbanization, Rural areas.
Identifiers: *Particulates, *Surveillance systems.

Types of pollutants and their sources are summarized, current instrumentation and anticipated development of more specific and sensitive sensors are described, and the contrast between air quality in our urban environment and that of rural areas is discussed. Gaseous pollutants make up about 90% of the total mass emitted to the atmosphere with particulates and aerosols accounting for the remainder. Particularly important are small particulates in the respirable size range which may contain biologically active elements and compounds. These tend to remain in the air and interfere with both solar and terrestrial infrared radiation, which may affect global climate. Most devices and analyzers used for measuring air pollution are based on wet chemical methods. Extensive research is under way to develop remote sensing devices for use at ground level, in aircraft, and in earth satellites for area scanning and profiling. Concentrations of small particulates in rural areas of the country are increasing. Gaseous concentrations in larger cities show no trend, indicating downtown areas probably are source--saturated. (Lang-USGS)
W71-00394

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.

International Lake Erie Water Pollution Board and International Lake Ontario-St. Lawrence River Water Pollution Board Report to International Joint Commission, 3 Vol, 1969. 796 p.

Descriptors: *Lake Erie, *Lake Ontario, *St. Lawrence River, *Water pollution, *Water pollution control, Surveys, Sampling, Legislation, Governments, International commissions, Great Lakes, Eutrophication, International waters.
Identifiers: International water pollution control boards.

Investigations were made to determine the extent and nature of pollution in the waters of Lake Erie, Lake Ontario and the international section of the St. Lawrence River. Data on which the report is based cover the period from 1963 through 1967, but further source information has been added in order to include significant observations. Lake Erie, Lake Ontario and the international section of the St. Lawrence River are being polluted on both sides of the boundary to an extent that is causing and is likely to cause injury to health and property on the other side of the boundary. There is substantial mixing of waters in the lakes to the extent that concentration levels of polluting materials are remarkably uniform throughout extensive areas of each lake. Thus, there appears to be no doubt that all major sources of pollution to the lakes have contributed directly, or indirectly, to their generally degraded condition. The major sources of pollution to the referenced waters are municipalities and industries. Municipal wastes comprise the principal source of phosphorus to the lower lakes. Municipal and industrial wastes also contribute dissolved and suspended solids, oxygen-consuming materials, toxic substances and pathogens. Remedial programs are suggested to be carried out promptly and on a continuing basis, to reverse the deteriorating conditions of the lakes. (Knapp-USGS)
W71-00397

TOWN OF DICKSON V STEPHENS (SPECIAL DAMAGE REQUIRED TO RECOVER FOR POLLUTION DAMAGE FROM MUNICIPALITY).
For primary bibliographic entry see Field 06E.
W71-00425

SMITH V BAY STATE DREDGING AND CONTRACTING CO (NEGLIGENT POLLUTION OF WATER BY DREDGING UNDER GARBAGE DISPOSAL WHARF).
For primary bibliographic entry see Field 06E.
W71-00515

KYSER V NEW YORK CENT RR (RIPARIAN RIGHT TO MAKE REASONABLE USE OF RIVER'S WATERS).
For primary bibliographic entry see Field 06E.
W71-00518

EWANSKI V SOLVAY PROCESS CO (LIABILITY FOR DEPOSITION OF INDUSTRIAL WASTE UPON LAND WHEN STREAM OVERFLOWS).
For primary bibliographic entry see Field 06E.
W71-00520

COOK V TOWN OF MEBANE (MUNICIPALITY'S LIABILITY FOR DIVERSION AND POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-00524

MOSES V TOWN OF MORGANTON (JOINT LIABILITY OF SEVERAL POLLUTERS).
For primary bibliographic entry see Field 06E.
W71-00525

ANDERSON V TOWN OF WAYNESVILLE (MUNICIPALITIES' LIABILITY FOR POLLUTION CAUSED BY SEWAGE DISCHARGE).
For primary bibliographic entry see Field 06E.
W71-00527

RHODES V INTERNATIONAL PAPER CO (LIABILITY FOR DAMAGES CAUSED FOR DISCHARGE OF INDUSTRIAL WASTES).
For primary bibliographic entry see Field 06E.
W71-00531

STANDARD OIL CO V GOODWIN (FOULING OF LANDS BY ESCAPE OF SEDIMENT FROM STORAGE TANKS).
For primary bibliographic entry see Field 06E.
W71-00537

NORTON COAL MIN CO V WILKEY (POLLUTION OF STREAM AND FARM BY COAL MINING WASTES).
For primary bibliographic entry see Field 06E.
W71-00541

5C. Effects of Pollution

EFFECTS OF ACID MINE WASTES ON PHYTOPLANKTON COMMUNITIES OF TWO NORTHERN ONTARIO LAKES,
Ontario Water Resources Commission, Toronto.

M. G. Johnson, M. F. P. Michalski, and A. E. Christie.
Journal Fisheries Research Board of Canada, Vol 27, No 3, p 425-444, 1970. 5 fig, 6 tab, 19 ref.

Descriptors: *Acid mine water, *Phytoplankton, *Lakes, Primary productivity, Waste treatment, Hydrogen ion concentration, Sulfates, Nitrates, Calcium, Carbon dioxide, Phosphorus, Silica, Chrysophyta, Cyanophyta, Lake Huron, Radioactivity, Radium radioisotopes, Physicochemical properties, Depth, Sampling, Bioassay, Ions, Carbon radioisotopes, Light penetration, Temperature, Diatoms, Ecosystems, Chlorophyceae, Water pollution effects, Water pollution sources.
Identifiers: *Ontario (Canada), *Uranium, Inorganic carbon, Dunlop Lake (Canada), Quirke Lake (Canada), Pecors Lake (Canada).

Differences between lakes contaminated by uranium-milling wastes and one unaffected lake were related directly to uranium extraction processes and subsequent waste treatment. Low pH and high concentrations of sulfates, nitrates, and calcium occurred in contaminated lakes; low concentrations of inorganic carbon, apparently limiting production, resulted from reduced solubility, loss, and possibly inefficient regeneration of carbon dioxide. Other major nutrients did not appear limiting, since there were more nitrates in contaminated lakes than in control lake; phosphorus and silica occurred in similar concentrations in all lakes. Lower phytoplankton populations and lower diversity indices were found in contaminated lakes; many species of Bacillariophyceae, Chrysophyceae, and Myxophyceae developed in unaffected lake but were absent or occurred rarly in contaminated lakes, with average primary productivities much lower. Bioassays confirmed the importance of inorganic carbon in limiting primary productivity. A potential compensatory mechanism in contaminated lakes was deepening of the euphotic zone. Although greater concentrations of inorganic carbon occurred and were assimilated in hypolimnetic than in epilimnetic waters, this did not overcome effects of reduction in species diversity and abundance of phytoplankton on areal primary productivity. (Jones-Wisconsin)
W71-00114

CONDENSED PHOSPHATES IN LAKE WATER AND WASTE WATER,
Toronto Univ. (Ontario). Dept. of Civil Engineering; and McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 02K.
W71-00116

BIOLOGICAL AND CHEMICAL INVESTIGATIONS ON THE EFFECT OF SEWAGE ON THE EUTROPHICATION OF BAVARIAN LAKES,
For primary bibliographic entry see Field 02H.
W71-00117

CONTRIBUTION OF RANGE LAND RUNOFF TO LAKE EUTROPHICATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 02H.
W71-00118

EUTROPHIC EVALUATION OF A SMALL MULTI-LAND USE WATERSHED,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
Alphonse E. Zanoni.
Available from NTIS as PB-194 755, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, June 30, 1970. 77 p. OWRR Project A-014-WIS (1).

Descriptors: Phosphorus compounds, *Eutrophication, Runoff, Fertilizer, Streams, *Watershed, Land-use, *Lake Michigan, Watershed management, Water pollution sources, *Phosphates, Farm wastes.
Identifiers: Menomonee River, Phosphorus loadings correlated to precipitation.

The Menomonee River watershed is a multi-land use watershed of 135 square miles area tributary to Lake Michigan. Approximately 370,000 people reside in the watershed which is 38% agricultural, 23% residential and the remainder divided among the other land use categories. Fifteen sampling sites were selected to evaluate the phosphorus loading from the watershed during various times of the year. During the two year investigation period, 30 sampling surveys were conducted and the samples were analyzed for total soluble phosphorus. A statistical investigation of the data showed that the phosphate concentration could not be correlated with precipitation amount, whereas, phosphorus pound loading could. The amount of phosphorus conveyed by runoff during precipitation periods varied considerably depending upon the amount of precipitation; varying from negligible amounts during low precipitation periods to high value of 83 pounds of phosphate per day per square mile during high precipitation periods. It was estimated that 1250 pounds per day of phosphate are discharged into Lake Michigan from the Menomonee River watershed, of which 40% is from treatment plant effluents.
W71-00141

EFFECTS OF A CONCENTRATED ACID ON WATER CHEMISTRY AND WATER USE IN A PLEISTOCENE OUTWASH AQUIFER,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 05B.
W71-00194

POTENTIAL THERMAL EFFECTS OF AN EXPANDING POWER INDUSTRY: OHIO RIVER BASIN I,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
D. E. Peterson, and R. T. Jaske.
AEC Research and Development Report, BNWL-1299, UC-70, February 1970. 63 p, 22 fig, 9 tab, 8 ref.

Descriptors: *Ohio River, *Thermal pollution, Cooling water, Thermal capacity, Evaporation, Conduction, Water pollution effects, Waste water treatment, Powerplants.
Identifiers: *ORSANCO, *COLHEAT, Topping ponds, Topping towers, Back-end loading, Advected energy, Projected conditions.

Simulations of 1964 average stream temperatures of the Ohio River System were performed using the COLHEAT computer code. Average monthly direct cooling capacities of the Ohio River and its major tributaries (excluding the Cumberland and Tennessee Rivers) within a 5 deg F envelope were calculated and found to range between 261,000 and 95,000 MW sub T. Projected stream-electric loads and cooling facility trends for the Ohio Basin indicate that direct cooling water requirements will equal low monthly average direct cooling capacity by the year 1990. Ancillary cooling facilities for low flow periods could extend the use of direct cooling for a major part of the cooling requirements through the turn of the century. (Osborne-Vanderbilt)
W71-00235

THERMAL ADDITION AND THE BENTHOS, CAPE COD CANAL,
Fish and Wildlife Service, Fort Hancock, N.J.
Jack B. Pearce.
Chesapeake Science, Vol 10, No 3 and 4, p 227-233, Sept-Dec 1969. 5 fig, 2 tab.

Descriptors: *Thermal pollution, *Temperature, *Benthos, Mussels, Ecology, Heated water, Water pollution effects.
Identifiers: Cape Cod Canal, Fin-fish.

Based on laboratory experimentation and field observations a study was conducted concerning the possible effects of thermal additions on the finfish and benthic mussel communities found in Cape Cod Canal. The results from a variety of laboratory experiments suggest that temperatures of 25C adversely affected most of the experimental organisms. Fish moved from 15.5C to 31C died within one hour. Mussels can tolerate alternate exposure to hot and cold over long periods. The larvae and plantigrade spat of mussels are far more tolerant of temperatures increase than adults. Changes in mussel behavior were evident at temperatures well below those which are normally lethal. Thermal additions affect the feeding rates of the dominant predators on Mytilus, thus possibly affecting community stability. Elevated temperatures were also found to affect finfishes which are normally associated with mussel communities. (Upadhyaya-Vanderbilt)
W71-00245

THERMAL INFLUENCE ON INVERTEBRATE RESPIRATION,
Duke Univ., Beaufort, N.C. Marine Lab.
F. John Vernberg, and Winona B. Vernberg.
Chesapeake Science, Vol 10, No 3 and 4, p 234-240, Sept-Dec 1969. 8 fig, 1 tab.

Descriptors: *Temperature, *Invertebrates, *Respiration, *Metabolism, Life cycles, Habitats, Water pollution effects.
Identifiers: Cyclic changes, Body size.

Most invertebrates cannot maintain a body temperature independent of their environment. However, various physiological and ecological strategies have evolved that enable poikilotherms to metabolically compensate for thermal changes. To evaluate the probable metabolic success of an organism in a region of thermal additions, a number of factors need to be considered. These include body size, stage in the life cycle of an organism, cyclic changes, and the habitat of the animal. Metabolic-temperature curves are somewhat characteristic for species even though the shape and position of the curve may be changed by thermal acclimation. This is best demonstrated by studies involving adult trematodes. (Upadhyaya-Vanderbilt)
W71-00246

TEMPERATURE AND ZOOPLANKTON,
Maryland Univ., Solomons. Natural Resources Inst.
Donald R. Heinle.
Chesapeake Science, Vol 10, No 3 and 4, p 186-209, Sept-Dec 1969. 18 fig, 8 tab, 22 ref.

Descriptors: *Zooplankton, *Temperature, *Metabolism, Thermal powerplants, Growth rates, Predation, Water pollution effects.
Identifiers: *Thermal tolerance, Seasonal pattern.

All metabolic rates of zooplankton are dependent upon temperature. Siefken and Armitage have suggested independence from temperature in some cases but with non-conclusive evidence. Rates generally rise in a linear fashion, with one or two inflection points when plotted on a semi-log scale, and fall at higher temperatures. The upper limits of thermal tolerance for two species of copepods from Chesapeake Bay were found to be near the normal temperature of the habitat during the summer. Acclimation temperature had little effect on the upper limits of thermal tolerance. Estuarine copepods were killed by passage through the condensers of a powerplant, although temperatures encountered were generally below the upper limits of thermal tolerance. Chlorine gas was applied at relatively high rates at that particular powerplant and is suspected to be the cause of mortalities. The operation of the powerplant did not alter the seasonal patterns of distribution or production of estuarine copepods. (Upadhyaya-Vanderbilt)
W71-00247

GREENING AND COPPER ACCUMULATION IN THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA, IN THE VICINITY OF A STEAM ELECTRIC GENERATING STATION,
Maryland Univ., Solomons. Natural Resources Inst.

Willem H. Roosenburg.
Chesapeake Science, Vol 10, No 3 and 4, p 241-252, Sept-Dec 1969. 5 fig, 21 ref.

Descriptors: *Oysters, Aquatic environment, *Temperature, Thermal powerplants, *Copper, Salinity, Water pollution effects.
Identifiers: Concentrations, *Greening, Condition index.

The effects of heated effluent on oysters in the Patuxent River were investigated. Oyster meats near the outfall of a steam electric generating station started to display green color shortly after initiation of plant operation. In time, the affliction increased in intensity and spread to oyster stations farther removed from the outfall. The greening of Patuxent oysters was probably caused by copper uptake, since green color and copper concentration (mg of copper per g dried meat weight) were closely correlated. Copper content of oysters decreased with distance from the outfall. There was an inverse relationship between oyster condition and copper concentration. This was most evident at stations near the outfall where oysters had high copper content. Amounts of copper per oyster, based on mg of copper per liter shell cavity volume, did not display great seasonal fluctuation. Oysters at special stations, established to investigate a possible copper source upstream from the plant, showed a reduction in mg of copper per g dried meat, while oysters at stations inside and near the outfall increased sharply in mg of copper per g dried meat. Indications in the Patuxent point to a relationship between oyster copper uptake and power plant operation. (Upadhyaya-Vanderbilt)
W71-00248

THE USE OF CHLORINE IN THE COOLING WATER SYSTEM OF COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
R. S. A. Beauchamp.
Chesapeake Science, Vol 10, No 3 and 4, p 280, Sept-Dec 1969.

Descriptors: *Cooling water, *Chlorine, *Mussels, Water pollution effects, Powerplants.
Identifiers: Coastal stations, Bacterial slime, Growth.

In the intake conduits of coastal power stations marine fouling may build up to a remarkable extent. In two extreme cases the amount of marine fouling, consisting of barnacles, tube worms, mussels and debris, has exceeded 300 tons. The greatest hazard to station operation arises from the growth of mussels as these grow to a size that they can, when detached, block or partially block condenser tubes. The schedule now being used is to inject chlorine continuously at a rate of 0.5 ppm. It seems that combined chlorine or combined bromine, probably in the form of bromamines, is extremely distasteful to mussels. Bacterial slime that forms in the condensers can be controlled by injecting chlorine at 2-3 ppm for 15 minutes every 6 hours. The adoption of a schedule of low level chlorination for the control of marine fouling has made it possible to carry out trials on the farming of sea fishes using the warm water discharged from power stations. (Upadhyaya-Vanderbilt)
W71-00249

ALLOWABLE THERMAL POLLUTION LIMITS - A PHYSICOCHEMICAL APPROACH,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
Walter Drost-Hansen.
Chesapeake Science, Vol 10, No 3 and 4, p 281-288, Sept-Dec 1969. 22 fig, 33 ref.

Descriptors: *Thermal pollution, *Temperature, Membranes, Viscosity, Respiration, Water pollution effects, *Physicochemical properties.
Identifiers: Conductance, Biochemical reaction, Optical density.

The existence of abrupt changes, at certain discrete temperatures, in biochemical reaction rates and in the behavior of biological systems, has been known for years. In systems where no active transport is expected, anomalies are often observed in the vicinity of 15, 30, and 45C. It appears, in general, that water near interfaces, regardless of solute present, is capable of undergoing abrupt changes, probably reflecting higher order phase transition. An upper thermal limit for the survival of many organisms is found to be at 30-33C. Multiple temperature optima in an organism may be the result of the utilization temperature intervals. A very intense, concerted study of the simultaneous influences of various parameters, including temperature, at closely-spaced values of the parameters, is needed. (Upadhyaya-Vanderbilt)
W71-00250

DETERMINATION OF UPPER TEMPERATURE TOLERANCE TRIANGLES FOR AQUATIC ORGANISMS,
Maryland Univ., Solomons. Natural Resources Inst.
Andrew J. McErlean, Joseph A. Mihursky, and Howard J. Brinkley.
Chesapeake Science, Vol 10, No 3 and 4, p 293-296, Sept-Dec 1969. 3 fig, 8 ref.

Descriptors: *Aquatic environment, Fish, *Temperature, Resistance, Thermal pollution, Water pollution effects.
Identifiers: *Tolerance polygon, Linearity, Aquatic organism, Rank correlation, Acclimations.

Temperature tolerance polygons are constructed by plotting lethal temperatures (LD50) for different acclimations against the temperature of acclimation, Ta. Area of the polygons give thermal tolerances. The effect of plotting (LD50-Ta) against Ta is to linearize the LD50 points. To examine this linearity, the difference (LD50-Ta) was determined for a variety of fish species and plotted against Ta. In most cases a line may be fit to the data points by eye since the data points are virtually colinear. The calculated upper tolerances for these 18 species were compared to those given in Brett by rank correlation. A rank correlation of 0.95 was obtained although some rank inversions occurred. The advantage of the method is that the area defined by the triangle may be easily measured and upper temperature tolerance may be expressed as a single numerical value. Relatively few LD50 determinations, perhaps as few as four, are required to obtain an estimate of upper tolerance. A possible limitation of the technique is that it may overestimate upper tolerance for temperature - intolerant organisms at higher acclimations. (Upadhyaya-Vanderbilt)
W71-00251

THE DIURNAL CURVE IN ESTIMATES OF PRIMARY PRODUCTIVITY,
Federal Water Pollution Control Administration, Alameda, Calif. Southwest Region.
For primary bibliographic entry see Field 05A.
W71-00252

DESTRUCTION OF PHYTOPLANKTON IN THE COOLING WATER SUPPLY OF A STEAM ELECTRIC STATION,
Maryland Univ., College Park. Dept. of Zoology.
Raymond P. Morgan, II, and Raymond G. Stross.
Chesapeake Science, Vol 10, No 3 and 4, p 165-171, Sept-Dec 1969. 3 fig.

Descriptors: *Thermal pollution, *Phytoplankton, *Photosynthesis, Temperature, Time, Primary productivity, Water pollution effects.
Identifiers: Cooling water supply, Steam electric station, Carbon uptake, Thermal inhibition.

Rates of photosynthesis were used to evaluate the response of phytoplankton when passed through the cooling system of a power generating facility. Photosynthesis was measured as the uptake of carbon. A factorial design permitted evaluation of heat input, total effect of passage, and degree of recovery. Six experiments measured response at a fixed time of day and at various times in a daily cycle. An increase in temperature of approximately 8.0C stimulated photosynthesis when natural water temperatures were 16C or cooler and inhibited photosynthesis when natural water temperatures were 20C or warmer. Passage through the cooling system resulted in further inhibition when the water was warm and nullified thermal stimulation when the water was cool. No recovery was observed within a four hour period following passage. Photosynthesis in cooled effluent water was either unaffected or actually suppressed. The existence of daily synchrony in the algae was shown by a daily maximum of thermal stimulation at 0900. The rhythm is considered inherent and only amplified by warming. (Upadhyaya-Vanderbilt)
W71-00253

TEMPERATURE AND ROOTED AQUATIC PLANTS,
American Univ., Washington, D.C. Dept. of Biology.
Richard R. Anderson.
Chesapeake Science, Vol 10, No 3 and 4, p 157-164, Sept-Dec 1969. 4 fig, 2 tab.

Descriptors: *Temperature, *Rooted aquatic plants, Respiration, Statistical methods, *Heated water, Water pollution effects.
Identifiers: Oxygen consumption, Leaf size, Ruppia maritima, Potamogeton perfoliatus.

In relation to the disappearance of a Ruppia maritima population near the effluent of an electrical generating station on the Patuxent River, Maryland, temperature effects on respiration and photosynthesis of aquatic plants was studied. A Gilson differential respirometer was used to investigate respiratory variation in leaves of Potamogeton perfoliatus at 25, 30, 35, 40, and 45C. This species grows with Ruppia maritima, appears to be more tolerant of high temperatures, and plant material was readily available. Plants growing in heated and non-heated water were compared. The data indicate that Potamogeton perfoliatus is capable of physiological adjustment to higher temperatures as the leaf matures, since only older leaves tended to respire less at the elevated temperatures. Death of plant material occurred at 45C. (Upadhyaya-Vanderbilt)
W71-00254

THE STATUS OF THERMAL DISCHARGES EAST OF THE MISSISSIPPI RIVER,
Bronx Community Coll., N.Y. Nursing Center.
For primary bibliographic entry see Field 05B.
W71-00255

SOME ECOLOGICAL RELATIONSHIPS OF THE ORGANIC DRIFT IN PRATER'S CREEK, PICKENS COUNTY, SOUTH CAROLINA,
Clemson Univ., S.C. Dept. of Entomology and Zoology.
William Kenneth Reisen.
Unpublished Masters Thesis, Clemson University, Clemson, South Carolina. December 1968. 127 p, 13 tab, 35 fig, 75 ref. OWRR Research Report A-013-SC (5).

Descriptors: *Organic drift, *South Carolina, *Ecological Relationships, Regression analysis, Qualitative, Quantitative, Fluctuations, Density dependency, Carrying capacity, Productivity, Seasonal, *Benthic fauna, Abundance, Feeding activity, Spawning, Plumpness, Temperature, Oxygen concentration.
Identifiers: *Reptilia, *Amphibia, *Osteichthyes, Cyprinoiformes, Perciformes, *Insecta, *Crustacea, *Bottom communities, Literature review, Condition factor.

An ecological study was conducted in Prater's Creek, Pickens County, South Carolina to observe the qualitative and quantitative fluctuations of the

organic drift through time, both diurnally and monthly. The relationships of organic drift with benthic density and emergence were investigated. The density dependency of the drift was tested to ascertain its relationship with carrying capacity and productivity. The dependency of the fish community on drift as a food source was also investigated. It was concluded that drift fluctuates both qualitatively and quantitatively through time as a function of light, time of day with density and seasonally. The relationship between drift and benthic density and relative abundance was found to be both density dependent and density independent depending upon the taxa considered. Consequently, the overall productivity of a given stream segment could not be estimated on the basis of drift. Fish were found to depend only slightly on drift for food. This was a function of both habitus and habitat. Feeding activity, condition factor and spawning of the fish were all found to be synchronized with fluctuations in the total drifting biomass. (ahtola-Washington)
W71-00303

EFFECTS OF SAN DIEGO'S WASTE WATER DISCHARGE ON THE OCEAN ENVIRONMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
Carl W. Chen.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1458-1467, August 1970. 10 p, 3 fig, 7 tab, 3 ref.

Descriptors: *Outlets, *Sewage disposal, *California, *Water pollution effects, *Aquatic life, Aquatic habitats, Aquatic environment, Sea water, Water quality, Water pollution sources.
Identifiers: Marine outfalls, San Diego (Calif).

Studies of the ocean environment near the city of San Diego waste water outfall include variance and time series analyses to discern physical, chemical, and biological changes and population trend and composition of biota. The outfall performed effectively in diffusing wastes to the environment. The environment was gradually reaching an equilibrium state. The marine ecosystem was relatively stable in both planktonic and benthic composition. The benthic populations were stimulated by the waste discharge and the deposit of organic matter. (Knapp-USGS)
W71-00347

EFFECTS OF ACID MINE DRAINAGE ON WATER QUALITY OF A RESERVOIR,
Pennsylvania Dept. of Health, Harrisburg. Div. of Water Quality; Missouri Univ., Columbia. Dept. of Zoology; and Missouri Dept. of Conservation, Columbia. Div. of Fisheries.
Edward R. Brezina, Robert S. Campbell, and James R. Whitley.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1429-1436, August 1970. 8 p, 4 fig, 4 tab, 19 ref. OWRR Project B-001-MO.

Descriptors: *Acid mine water, *Water pollution effects, *Reservoirs, *Missouri, Sulfates, Acids, Mine drainage, Water quality, Alkalinity, Monitoring, Water pollution sources, Water chemistry.
Identifiers: Montrose Reservoir (Mo).

To determine whether acidic water draining from strip mines altered the water quality of Montrose Reservoir and tributary Deepwater Creek in Missouri, water samples were analyzed for pH, potential free acidity, specific conductance, bicarbonate alkalinity, and sulfate ion concentration. Acid inflow resulted in a slight increase in specific conductance, a slight decrease in bicarbonate alkalinity, and a slight increase in sulfate ion concentration in Montrose Reservoir. The relationship of time of acid inflow to rainfall was established by hourly monitoring of water quality in Deepwater Creek before, during, and after heavy rainfall. Changes in water quality were minimal except immediately after precipitation began. (Knapp-USGS)
W71-00372

THE INFLUENCE OF FLOW ON THE SPAWNING OF BROOK TROUT IN THE LABORATORY,
National Water Quality Lab., Duluth, Minn.
John G. Hale, and Donald A. Hilden.
Transactions of the American Fisheries Society, Vol 99, No 3, p 595-597, July 1970. 1 tab, 4 ref. FWQA Project ETK 18050---9/70.

Descriptors: *Spawning, *Life History Studies, *Bioassay methods, Water pollution effects.
Identifiers: Flowing-water system, Substrate.

Information was needed on the spawning success of adult brook trout maintained on a diet of commercial trout pellets in the laboratory under controlled light through one complete reproductive cycle. It was also planned to determine whether or not brook trout would spawn in the test tanks where the flow was periodic and compare the results with spawning in coninuous flow at a constant delivery rate. Gravel, 1/4 to 1 inch in diameter and glass marbles 1/2, 9/16, and 7/8 inch in diameter were tried as spawning substrate. Marbles were tried because glass does not react with most toxicants; whereas, it is possible that gravel might react with some toxicants to alter the concentration in a long-term study. Spawning was not considered successful with marbles since no eggs were buried. The female in the tank containing marbles was spent indicating that she had spawned but her eggs were exposed, and probably onsumed by fish in the tank. Spawning took place in tanks with a constant flow, as well as in tanks with periodic flow. The rate did not appear to influence spawning success, since it was accomplished at 1/2, 1, and 2 liters a minute. (Hale-FWQA)
W71-00407

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
Pat C. Kerr, Doris F. Paris, and D. L. Brockway.
Available from NTIS as PB-195 195, $0.95 in microfiche. Also for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.60, I67.13/4:16050 FGS 07/70. Water Pollution Control Research Series 16050 FGS 07/70, (July 1970). 53 p, 4 tab, 17 fig, 51 ref. FWQA Project 16050 FGS.

Descriptors: Cycling nutrients, *Carbon, *Phosphorus, *Cyanophyta, Aquatic environment, Carbon dioxide, Ecosystems, South Carolina, Algae, Trophic level.
Identifiers: *Antotrophic populations, *Heterotrophic populations, Lake Hartwell (South Carolina), Anacystis nidulans, Aquatic ecosystems, Algae growth, Algal populations.

Laboratory and field investigations were conducted on the fate and cycling of carbon and phosphorus in selected aquatic ecosystems. Inorganic carbon, as CO2, supplied by both bacterial cultures and cylinder gases, stimulated the growth of the blue-green alga Anacystis nidulans. The carbon requirement (10-5 ug CO2 per cell) for this alga was determined for a single set of experimental conditions. The addition of CO2 to natural water low in phosphorus (5 ug P) and nitrogen (5 ug N) in the laboratory stimulated the growth of indigenous algal populations. The limiting and luxury cellular concentrations of phosphorus for starved Anacystis nidulans were found to be 0.3 x 10-8 ug P and 3.0 x 10-8 ug P per cell, respectively. Diel studies of a stream which received biologically-treated sewage demonstrated that the dissolved CO2 and HCO3 continually produced in the system were essentially depleted by the autotrophic organisms during daylight hours, while the concentration of phosphorus (1.3-2.2 mg/l P) remained unchanged. Addition of organic carbon and inorganic nitrogen and phosphorus along and in combination to the waters studied directly stimulated the oxidative metabolism of the heterotrophic population, which resulted in increased dissolved CO2 and HCO3-. This increased availability of inorganic carbon, rather than the direct metabolic removal of dissolved phosphorus by the algae, appeared to be directly responsible for the growth of the algal populations in the waters studied.
W71-00475

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
For primary bibliographic entry see Field 06E.
W71-00530

NAUVOO BLACK CREEK COAL CO V JOHNSON (LIABILITY FOR SUBSTANTIAL INJURY CAUSED BY STREAM POLLUTION).

160 So 242-244 (Ala 1935).

Descriptors: *Alabama, *Cultivated lands, *Damages, *Water pollution, Pollutants, Watercourses (Legal), Pollutant identification, Overflow, Riparian land, Riparian waters, Riparian rights, Relative rights, Mining, Mine wastes, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner sought damages for alleged permanent injury to his property, agricultural lands, which he alleged was caused by defendant's pollution of a stream running therethrough. From a judgement for plaintiff, defendant appealed based on the trial court's charge to the jury. The court held to be adequate a charge to the jury that while defendant had the right to use the stream above plaintiff's land for mining purposes, he did not have the right to place in said stream or tributaries thereof any substance that would be deposited on plaintiff's land that would cause injury or deterioration thereto. The omission of the words 'substantial' or 'material' from said charge did not mislead the jury in light of the court's oral charge that plaintiff could recover only for substantial injury. The judgment for plaintiff was affirmed. (Price-Florida)
W71-00536

5D. Waste Treatment Processes

WASTE WATER TREATMENT FOR RETURN TO NATURAL CYCLE REUSE,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
F. M. Middleton.
Water and Wastes Engineering, Vol 5, p 61-64, 1968. 1 fig, 2 tab, 12 ref.

Descriptors: *Waste treatment, *Waste water disposal, *Water reuse, Water purification, Oxygen demand, Solid wastes, Bacteria, Nutrients, Waste water treatment, Anaerobic digestion, Phosphorus, Nitrogen, Thermal pollution, Dissolved solids, Odor, Disinfection, Economics, Water quality.
Identifiers: Nutrient removal, Water quality criteria.

Changes of concepts and treatment processes to adequately control natural recycle and reuse of waste water effluents are discussed. Treatment can be improved by better operation of existing plants: controlling organic and hydraulic overloads, operation of facilities and adequate testing to permit optimum operation. New plants should be designed to eliminate digesters since large amounts of biochemical oxygen demand, nitrogen, and phosphate in supernatants or elutriates are returned to the process only to cycle again and discharge into the effluent. For new processes consideration should be given whether new problems are created. Better removal of oxygen-demanding materials is required, as well as a large percentage of carbon and nitrogen in wastes. Present technology can reduce phosphorus by 80% without large capital expenditures. The diversity of waste treatment systems allow their application to local situations. Nitrogen removal is feasible by ammonia stripping and biological nitrification-denitrifica-

tion; other techniques lack adequate full-scale testing. More effort must be directed to eliminate dissolved solids, heat, and odor-potential of discharged wastes. Disinfection is more effective and economical when the effluent is free of solids, organics, and ammonia. (Haskins-Wisconsin)
W71-00107

INORGANIC CHEMICAL INDUSTRY: CLEAN WATER COST ESTIMATE.

Environmental Science and Technology, Vol 14, No 6, p 469-470, June 1970. 1 fig.

Descriptors: *Costs, *Chemicals, *Inorganic compound, *Waste water treatment, Industrial wastes.

'Economics of clean water' the third annual report to Congress on the cost of clean water for the United States contains waste water treatment profiles for municipalities animal feed lot wastes, and inorganic chemicals industry. This report details the in-depth cost estimates achieving certain levels of waste water treatment within these particularly troubled areas. During the 5 year period from 1970 to 1974 the inorganic chemicals industry will have to increase outlays nearly 8 fold to reach the 100% level of treatment. To keep its present level of treatment the industry must increase present outlays for capital and operating expenses more than 50% from 414.5 million in 1970 to 630.2 million in 1974. The main problem with the treatment of industry's wastes is the solids, both dissolved and suspended. In general biological methods of treatment are not applicable for physical treatment of equalization, neutralization, flocculation, sedimentation, and sludge dewatering are employed. The cost estimates for treatment were developed for 4 levels of flow rates, 3 levels of acidity, 2 levels of suspended solids and 3 levels of total dissolved solids. However, the data from the 59 plants, representative of the 2,700 plants in the United States, were not sufficiently complete with regard to effluent quality to construct a statically significant relationship between the numbers of plant and the effluent quality parameter such as acidity, suspended solids, and dissolved solids. (Hancuff-Texas)
W71-00119

ACTIVATED SLUDGE (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
H. S. Azad, D. E. Bergmann, and M. R. Stumpf.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 897-910, June 1970. 105 ref.

Descriptors: *Activated sludge, *Waste water treatment, Sewage treatment, Biological treatment, Mathematical models, Aerobic treatment, Industrial wastes, Performance, Evaluation, Oxygenation, Temperature, Mixing, Nutrients, Costs, Microbiology, Toxicity, Economics.
Identifiers: Growth, Settling.

The 1969 literature on the activated sludge process is reviewed. A variety of process modifications is discussed, and include: rotating disc biological contactor and wasting activated sludge solids to the preaeration tank ahead of the primary settling tank. Industrial applications include: distillary wastes, slaughter house wastes, starch wastes, aliphatic compounds, vegetable tanning liquors, chrome tanning wastes, dye wastes, phenolic wastes, petrochemical wastes, and organophosphorus pesticides. The cost of a centrally combined industrial waste water treatment complex treating wastes from separate industries is presented. Evaluation of a thermophilic activated sludge system is presented and the influence of temperature on settling developed. The influences of oxygen transfer efficiency are described and a variety of aeration systems discussed. The influence of nutrients, namely, nitrogen and phosphorus are presented from the standpoint of kinetics as well as removal efficiencies. The inhibitory or toxic effects of various compounds on activated sludge process are discussed. Boron, cyanide and various metals are cited as examples. A variety of studies on the design and operation of settling, dewatering and thickening are described. (Hancuff-Texas)
W71-00120

STEEL INDUSTRY WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
S. E. Smith.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1198-1205, June 1970. 63 ref.

Descriptors: *Steel, *Industrial wastes, *Waste water treatment, Iron, Chemicals, Ion exchange, Electrodialysis, Oxidation, Neutralization.
Identifiers: *Pickling.

Recent literature pertaining to the steel industry wastes is reviewed. A large portion of the literature has been dedicated to ways of using the waste water as a product or ways of using one waste water to treat another. A great deal of attention was also devoted to the recycling of components of the waste water within the plant. A discussion is presented on several pilot plant studies made for the control of pollution from steel manufacturing in particular hot rolling. A very large number of studies were made on the treatment of pickling waste water. Several of these concentrated on merely meeting water quality requirements while others concentrated on recapture and reuse of the waste materials. The most commonly recovered items were gypsum and magnetic iron oxides. The processes such as chemical precipitation, ion exchange, electrodialysis, neutralization and oxidation are reported for the treatment of pickling wastes. The need for an iron containing fertilizers in arid regions and a non-sodium substitute for the sodium chloride regenerant in water softening are discussed in the light of using ferric chloride as a substitute. Ferric chloride is also recovered from pickle liquors. Deep-well injection of spent pickle liquors received some attention and the construction and operation of disposal is described. (Hancuff-Texas)
W71-00121

AGRICULTURAL (LIVESTOCK) WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
J. R. Miner.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1171-1179, June 1970. 59 ref.

Descriptors: *Agriculture, *Industrial wastes, *Waste water treatment, Odors, Cattle, Crops, Biological treatment, Dairy industry, Poultry.
Identifiers: Manure, Feed lots.

Recent literature concerning agricultural waste disposal is reviewed. The problems associated with water pollution control related to cattle feed lot runoff were discussed in relation to the characteristics, handling, treatment, utilization, disposal and odor problems of livestock manure. A review of research pertaining to swine waste management includes discussions of manure properties, application to cropland, treatment technology, alternatives for disposal or utilization, and gases and odors related to manure storage. The production, value, use, and disposal of poultry manure is also included. The value of poultry manure as a fertilizer for specific crops is discussed. A great deal of study has been made on the gases and odors evolved from manure decomposition and a court case is sited in which an award of $36,000 was made due to water pollution and odors. Some wastes which are characterized are from steer, sheep, poultry, and storm runoff from a variety of cropland. A great deal of study was done on cattle feed lot wastes and various methods of treatment. The application of partly treated livestock wastes to cropland has been of growing interest. The largest problem occurring with this type of disposal is the contamination of the groundwater by nitrogen mostly in the form of nitrates. A variety of biological treatment processes were studied including lagoon, aerated lagoons, extended aeration, anaerobic digestion, and aerobic digestion. (Hancuff-Texas)
W71-00122

PLATING AND CYANIDE WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
W. N. Grune.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1211-1230, June 1970. 97 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Metals, Water pollution control, Ion exchange, Chromates.
Identifiers: *Plating, *Cyanide, Recovery, Reuse.

In recent years, the use of electrochemistry to help clean up various industrial wastes, including those from steel pickling plants and plating operations, has steadily increased. The most important objectives of waste treatment of these industries is the removal or reduction of toxic materials. A great deal of interest was shown in the development of waste treatment plant automation and continuous analysis of effluent quality. A large number of examples of controls are presented. The possibility of treating cyanide wastes through biological treatment was shown by several investigators. Designs and operating characteristics of ion exchange units used for removal of plating wastes are discussed. A review of the various methods for cyanide control including (1) dilution, (2) alkaline chlorination, (3) electrolytic oxidation, (4) vacuum evaporation, and (5) ion exchange is presented. Commercially available equipment and processes also are reviewed. Potential recovery and reuse of cyanides and chromates is given some consideration and methods are described. The potential water pollution problem evolving from disposal of cyanides in water and streams is summarized. (Hancuff-Texas)
W71-00123

TANNERY WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
J. D. Eye.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1188-1189, June 1970. 13 ref.

Descriptors: *Industrial wastes, *Waste water treatment, Biological treatment, Activated sludge, Chromium, Sulfides.
Identifiers: *Tannery wastes, *Leather.

Recent literature on tannery wastes and tannery waste treatment is reviewed. The effect of trivalent chromium derived from tannery wastes on biological treatment processes was found to have little effect even at high initial concentrations because of the precipitation of chromium hydroxide on mixing with high alkaline wastes. Several biological pilot scale studies are reported. In one anaerobic-aerobic pilot unit the spent vegetable canning solutions derived from a sole leather tannery was treated to about 85% efficiency for the removal of BOD and suspended solids. A completely mixed activated sludge system on a pilot scale was studied for treating wastes from 5 other tanneries. BOD removals of 90% were observed. Chromium did not effect the process adversely. A pilot plant study of the treatment of the combined wastes from 19 tanneries, 8 other industries and 2 municipalities is discussed. A small scale two stage activated sludge system was utilized for studying tannery waste treatment and it was found that sulfides as high as 300 mg/l were not detrimental to the treatment. (Hancuff-Texas)
W71-00124

HIGH-RATE, FINE-MESH SCREENING OF COMBINED WASTE WATER OVERFLOWS,
Cornell, Howland, Hayes, and Merryfield, Corvallis, Oreg.

Donald M. Marske.
Journal of the Water Pollution Control Federation, Vol 42, No 8, p 1476-1494, August 1970. 13 fig, 6 tab, 3 ref.

Descriptors: *Screens, *Waste water treatment, *Sewage treatment, Pilot plants, Storm runoff, Costs, Efficiencies.
Identifiers: *Combined sewage.

Most combined sewers do not have a capacity during heavy storm periods to transport all of the waste and storm water to a treatment facility. This paper reports on (1) the character of the combined waste water overflows, (2) the treatment capability of high-rate, fine-mesh, screens, and (3) comparison of high-rate, fine-mesh, screening to other methods of treating combined waste water overflows. The screen unit produced the best results when operated at an influent flow rate of 1,700 gpm (130 gpm/sq ft) with a 165 mesh stainless steel collar screen rotating at a speed of 60 rpm. The screen unit is capable of treating comparable to a primary clarifier. The screened effluent flow is typically 90% of the influent. The screening unit is an economically feasible method of treating combined waste water overflows. Factors to be considered in the selection of screening are discussed. The estimated construction costs for a 25 mgd screening facility is $496,000. The estimated annual maintainance cost is $18,500. The cost of treatment is estimated at $0.22/1000 gal. (Hancuff-Texas)
W71-00127

A POLLUTION ABATEMENT PROGRAM FOR DISTILLERY WASTES,
American Distilling Co., Pekin, Ill.
R. G. Paulette, C. S. Boruff, and J. O. Nack.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1387-1394, July 1970. 6 fig, 2 tab.

Descriptors: *Industrail wastes, *Pollution abatement, *Waste water treatment, *Activated sludge, Sewers, Sewage treatment, Design flow, Aerobic treatment, Nutrients.
Identifiers: *Distillery wastes.

A program of pollution abatement at a distillery is presented. The facility has a capacity for 12,500 bushels of grain per day. and operates at 8,500 bushels per day. In the first stage of the pollution abatement program 27 sewers were identified, flows were monitored, and water samples were collected and tested. Sewerage improvements were recommended to separate the process and sanitary wastes. Contaminated water was redirected to seven sewers, to an interceptor sewer and the main row waste pumping station. The treatment efficiency of an activated sludge process was tested against nutrient concentration, mixed liquor suspended solids, unit weight of sludge produced per unit weight of BOD, pH, and temperature. A nutrient supplement would be required to treat the wastes through the aerobic process. An extended aeration plant was recommended in the preliminary report for a number of reasons: (1) It retains a large mass of active organisms to survive long weekend shutdowns, (2) It has the ability to dissipate extremes of pH, temperature and high organic loading, (3) It provides a cooling effect during treatment by the aeration process, (4) It offers greatest economy of installation and operating costs. Based on a 52-hour detention time at average flow, a biological loading of 20 lbs of BOD per thousand cubic feet is provided. Information presented is to provide some of the basic design criteria for other distillery waste plants. (Hancuff-Texas)
W71-00128

PERFORMANCE OF THE SOMERSET, OHIO, OXIDATION DITCH,
Ohio Univ., Athens.
Harry M. Kaneshige.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1370-1378, July 1970. 8 fig, 4 tab, 2 ref.

Descriptors: *Performance, Sewage treatment, Lagoons, Waste water treatment, Efficiencies, Ponds, Organic loading, Sludge, Costs, Drying, Activated sludge, Operations, Ohio.
Identifiers: *Oxidation ditch, Suspended solids, Expenses, Somerset (Ohio).

A three year study of the operation of a mechanically aerated oxidation ditch with final settling and sludge return was conducted at Somerset, Ohio. The plant serving about 1,500 people and treating predominantly domestic waste achieved excellent overall removal of suspended solids and BOD. Power consumption was about 1 kwh/cu m or 4 to 5 kwh/kg BOD removed. Power costs were about $20/1000 cu m of flow compared with about $28/1000 cu m for extended aeration plants. Surges and mechanical problems caused reduction in effluent quality but the plant recovered quickly. Extremely cold weather also caused poor performance. Extensive velocity distributions studies were made and several figures are presented illustrating the results. Monthly averages for BOD ranged from 150 to 300 mg/l averaging between 225 and 275 mg/l. Final effluent BOD ranged from 4 to 196 mg/l averaged around 8 to 10 mg/l. (Hancuff-Texas)
W71-00130

IDENTIFICATION AND SURFACTANT DEGRADING ABILITY OF BACTERIA 'STANDARD' SHAKE FLASK INOCULUM,
Army Natick Labs., Mass.
Morris R. Rogers, and Arthur M. Kaplan.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part I, p R263-R269, August 1970. 1 tab, 20 ref.

Descriptors: *Microorganisms, *Surfactants, *Bacteria, *Degradation (Decomposition), Laboratory tests, Detergents, Cultures, Standards, Activated sludge, Waste treatment, Linear alkylate sulfonates, Detergents, Waste water treatment.
Identifiers: *Identification, Media.

The shake culture presumptive test for measuring the biodegradability of linear alkylate sulfonate (LAS or soft anionic surfactant) used a mixed inoculum originially obtained from an activated sludge waste treatment system. Twenty species of bacteria were isolated from the culture using streak plates of (BBL) nutrient agar, endoagar and tryptone glucose extract agar. The results revealed that the dominant organism is Pseudomonas; in addition Achromabacter cycloclastes, Flavo bacterium, Morexella and Paracolobactrum intermedium were also isolated. Some reservation was employed in naming some of the organisms which did not exactly adhere to the description in Bergey's Manual, but were further classified in accordance with Shewan, Hobbs, Hodgkiss' scheme. Most of these pure culture isolates were found to degrade the standard test LAS surfactant at a rate equal to the standard mixed shake culture inoculum. (Hancuff-Texas)
W71-00131

EFFECT OF NITROLOTIRACETIC ACID ON THE GROWTH AND METABOLISM OF ESTUARINE PHYTOPLANKTON,
Marine Water Quality Lab., West Kingston, R.I.
S. J. Erickson, T. E. Maloney, and J. H. Gentile.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part II, p R329-R335, August 1970. 7 tab, 13 ref.

Descriptors: *Growth rate, *Metabolism, *Phytoplankton, Estuaries, Chelation, Detergents, Toxicity, Degradation (Decomposition).
Identifiers: *Nitrilotriacetic acid, NTA.

The effects of nitrilotriacetic acid (NTA) on the estuarian phytoplankton was examined in natural and synthetic sea water. NTA is of low toxicity to phytoplankton in the presence of adequate trace metals. The whole molecule is likely to produce trace metals deficiency in sea water at relatively low concentration, 1 to 5 mg/l. NTA is biodegradable by estuarian bacteria, however, phytoplankton were unable to directly metabolize NTA. The time estimated for degradation of NTA to CO2, H2O and inorganic nitrogen compounds has been determined to be one day. Therefore, the residence time within estuaries should be relatively short. The degradation products in sufficient quantity are likely to promote undesirable algal blooms. The NTA molecule when degraded by bacteria loses all chelating capacity and it is unknown whether metals released from degraded NTA chelates will produce toxicity. It is possible that they would either be sufficiently diluted or immediately complexed with sea water and create a toxicity problem. (Hancuff-Texas)
W71-00132

THE MATHEMATICS OF ACTIVATED SLUDGE CONTROL,
Brown and Caldwell, San Francisco, Calif.
Warren R. Uhte.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1292-1304, July 1970. 1 fig, 1 tab.

Descriptors: *Mathematical model, *Activated sludge, *Control, Sludge, Kinetics, Design.
Identifiers: Suspended solids, Wasting, Computations, Process control.

For the use of the mean cell residence or the solids retention time in the control of an activated sludge system, one must select the desired time, compute the total solids present in the system and determine the total volatile solids to be wasted per day. The solids in the system may be expressed as the sum of those in the aeration facilities secondary sedimentation units and the sludge return system. Solids are wasted both over the effluent weir and through the solids disposal system. Numerical examples show these computations for conventional, step feed, high rate and multiple step operations of an hypothetical plant. Assumed plant design is for a 18 mgd flow. The plant layout includes four aeration tanks, mixed liquor channel and return activated sludge channel, and four secondary sedimentation basins. (Hancuff-Texas)
W71-00133

CANNERY WASTE WATER TREATMENT BY HIGH-RATE SPRAY ON GRASSLAND,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr., Richard E. Thomas, and Leon H. Myers.
Journal of the Water Pollution Control Federation, Vol 42, No 9, p 1681-1631, September 1970. 8 tab, 12 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Grassland, *Sprays, *Canneries, Irrigation, Efficiencies, Cost, Nitrogen, Phosphorus.
Identifiers: Food processing.

A 12-month survey was conducted to determine the treatment and efficiency of a spray-runoff system for cannery wastes. A total of 133 inches of waste water was applied to each of 4 experimental areas. Hydrological measurements, mass removal efficiencies and soil water quality were evaluated in relation to age of the system, soil type and spray scheduling. Hydrological measurements showed that 18% of the applied water was lost through evaporative process, 61% returned to surface drains as runoff and the remaining 21% percolated through the soil. A normal once-a-day spray schedule resulted in 92% to 99% removal of the volatile solids and oxygen demanding organics, 83 to 90% removal of total nitrogen and 50% to 60% removal of the total phosphorus. The estimated capital cost of installing such a spray runoff system is approximately $1,000 per acre. The system is designed to handle up to 3.6 mgd on approximately 500 acres. Operating costs were estimated at $0.05/1000 gal of waste water treated. (Hancuff-Texas)
W71-00134

CHEMICAL AND ALLIED PRODUCTS (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
A. L. Mytelka.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1230-1231, June 1970. 11 ref.

Descriptors: *Chemicals, *Industrial wastes, *Waste water treatment, Biological treatment, Oxidation, Ozone, Radiation, Ponds.

The treatment of chemical and allied products received much attention in the literature of 1969. In addition to the traditional biological approach to treatment, the addition of external energy sources such as chemical oxidants has been reported on a wide variety of wastes. Dilution of the waste water from coal-tar plants with municipal waste water at a ratio of 1:7 proved satisfactory for biological treatment. It was also determined that phenols should not exceed 70 mg/l. Bayports industrial complex contains a central facility to treat wastes from six industries; they are in general separated into three categories: clean, biological, and nonacceptable. The use of aerated lagoons and ponds in refinery and chemical waste treatment is described. The reuse of phenolic-resin containing waters in a fiberglass plant was determined feasible. Biological treatments were found useful in the clean-up of polyester manufacturing operations and ethylbenzene production. Ozone was used to treat waste streams in a polymer plant as well as waste water from the production of isoprene. An investigation on the effects of radiation in treating a waste water containing cyanides, phenols, petroleum and related wastes is also discussed. (Hancuff-Texas)
W71-00135

DEEP-WELL INJECTION (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-00136

CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES,
Connecticut Argicultural Experiment Station, Storrs; California Univ., Davis; and California State Dept. of Public Works, Sacramento.
John F. Ahrens, Oliver A. Leonard, and Neal R. Townley.
Journal of the Water Pollution Control Federation, Vol 42, No 9, p 1643-1655, September 1970. 1 fig, 6 tab, 7 ref.

Descriptors: *Sewers, *Control, *Chemicals, *Trees, *Plants, Pipelines, Maintenance, Herbicides, Sewage treatment, Costs, Flooding.
Identifiers: *Roots, *Collection systems.

Studies were made of hebicides that would selectively kill tree roots in sewer lines by the flood technique. Toxicity of herbicides to roots and injury to foliage from root uptake was studied in woody container grown plants first to screen herbicides and then to determine the factors effecting toxicity in movement of metham and dichlobenil. The latter two were also tested in sanitary sewers. Solutions of dichlobenil at 100 mg/l killed all the roots except those of peach exposed for 10 to 60 minutes. Solutions of metham at 5000 mg/l killed most roots exposed for 1 minute or more. In sanitary sewers in Sacramento a one-hour flood treatment with metham, dichlobenil and combinations of the two killed all roots in the line and most of the roots in joints inspected. Metham also killed roots extending a short distance outside joints. The initial cost of chemical flooding and mechanical root removal were about the same, but chemical flooding is expected to reduce the cost of further sewer maintenance operations. The average cost of power rooting 50 miles of sewer lines was $0.11/ft including all labor, equipment and overhead. The flood method described in this paper was tested on 20,000 feet of 6 inch line. It cost $0.063/ft for chemicals and $0.053/ft for all labor, equipment and overhead. Therefore, a comparable cost of $0.113/ft was determined. (Hancuff-Texas)
W71-00137

SURFACE PROPERTIES AND ION EXCHANGE IN ALGAE REMOVAL,
California Univ., Richmond.
C. G. Golueke, and W. J. Oswald.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part II, p R304-R314, August 1970. 4 fig, 12 ref.

Descriptors: *Algae, *Harvesting of algae, *Ion exchange, Dissolved solids, Flocculation, Head loss, Hydrogen ion concentration, Chlorella, Scenedesmus, Waste water treatment.
Identifiers: *Surface charge, Regeneration, Suspended solids.

A facet of ion exchange yet to be reported in the literature is the use of ion exchange columns for the removal of cellular material having a surface charge. In experiments on the removal of algae from pond effluent it was found (1) In the presence of either strong or weak cation ion exchange resins, algal cells aggregate into tight clumps and settle in a cone-shaped mass on the top of each resin bead, (2) The aggregated cells are easily removed from the column by backwashing and retain their tendency to aggregate and settle in the displaced backwash, and (3) The exchange efficiency of the resin with respect to algal cells is but a small fraction of that with respect to cations in that the capacity for removing Mg..2, Ca..2, and other cations continues long after the capacity for removing algal cells is exhausted. Aggregation was its strongest within the pH range of 2.8 to 3.5 and dropped off sharply on either side of this range. Concentration of Na.., Ca..2, and Mg..2 from 0.5 to 4.0 millimoles did not affect the precipitation of the cells. Despite the simplicity of the process, the purity of the algal product, and the high quality of the reclaimed water attainable with it, until a regenerant less expensive than H_2SO_4 or HCl is found, the interest in the process must remain academic rather than economic. (Aguirre-Texas)
W71-00138

RELATIONSHIP OF CHLOROPHYLL A TO ALGAL COUNT AND CLASSIFICATION IN OXIDATION PONDS,
Lamar State Coll. of Technology, Beaumont, Tex.
Joseph V. Dust, and Adam Shindala.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1362-1369, July 1970. 7 fig, 7 ref.

Descriptors: *Algae, *Chlorophyll, *Classification, *Oxidation lagoons, Chlorella, Oxygen demand, Photosynthesis, Respiration, Scenedesmus, Waste water treatment.
Identifiers: *Enumeration, Anacystis.

A study was conducted aimed at obtaining a quantitative comparison of chlorophyll A with the total number of organisms in the Trinity River Authority waste water treatment plant as well as a comparison with the various species of algae existing from time to time in these oxidation ponds. The literature indicates that the analytical determination of chlorophyll pigments can be accomplished spectrophotometrically with the following equation: Chlorophyll A in mg/l — (14.3) d665, where d655 is the light absorbance at a wave length of 655 millimicrons and a slit width of 0.3 mm. Eight major types of algae were found in significant numbers: Oocystis, Anacystis, Chlorella, Desmids, Scenedesmus, Coelastrum, Zygnema, and Closterium. The Anacystis organism was found more frequently and in greater numbers than any other organism. The average weekly count of Anacystis varied from about 1 to 4 million per ml during the first 15 weeks of the study comprising the summer and early fall months of the year. Chlorella and Scenedesmus were the predominant organisms during the late fall, winter, and early spring months, with cell counts of 10,000 to 100,000 cells/ml. A relationship between chlorophyll A and total algal count was not found. However, a definite relationship existed between the amount of chlorophyll A and the number of Anacystis organisms present. A similar relationship was found with Zygnema. (Aguirre-Texas)
W71-00139

WATER POLLUTANT OR REUSABLE RESOURCE.

Environmental Science and Technology, Vol 4, No 5, p 380-382, May 1970. 2 fig.

Descriptors: *Waste water treatment, *Industrial wastes, Water resources, Deep wells, Waste disposal, Liquid wastes.
Identifiers: *Steel industry, *Pickling liquor, Recovery, Regeneration.

Spend liquor is an aqueous solution containing from about 0.5 to 10% acid and perhaps 12% iron. Either undissolved or in solution, if discharged untreated to a waterway it is a twofold menace, first for its acid content and second for its iron content. Depending on the chemical and physical form of the iron the liquor may turn the water muddy brown, deposit slime, and exert a strong oxygen demand. Huge amounts of pickling acid, 35 to 40 lbs for every ton of steel are used in the finishing operations. It is estimated that 8 to 15 gallons of spent liquor are produced per ton of steel pickled. Since 50,000,000 tons of steel are pickled every year, spent liquors are produced at a rate of half a billion gallons per year. There are essentially six types of approaches that can be taken for the disposal of spent pickle liquor: (1) discharge to a waterway, (2) deep well disposal, (3) neutralization, (4) hauling by contractor, (5) recovery processes, (6) regeneration processes. The fact that a few of the available recovery and regeneration methods are in actual use in the steel industries seems to be a reflection not so much on the technical uncertainties of these methods but of the fact that much simpler if less effective ways of disposal are still open, consistent to whatever local regulations are in effect. (Hancuff-Texas)
W71-00140

FEASIBILITY OF HYDROLYSIS OF SLUDGE USING LOW PRESSURE STEAM WITH SO-2 AS A HYDROLYTIC ADJUNCT AND UTILIZATION OF THE RESULTING HYDROLYSATE.
Federal Water Pollution Control Administration, Washington, D.C.

Available from NTIS as PB-194 784, $3.00 in paper copy, $0.95 in microfiche. Federal Water Pollution Control Administration Research Series, Report 17070 EKN 12/69, December 1969. 30 p, 5 fig, 9 tab, 10 ref. FWPCA Project 17070 EKN-12/69, Contract No 14-12-188.

Descriptors: *Activated sludge, *Hydrolysis, *Sludge disposal, Proteins, Byproducts, Waste disposal, Chemical reactions, Chemical degradation.
Identifiers: Sludge hydrolysis.

Sulfurous acid, when used with hydrolysis in the treatment of activated sludge, will increase soluble solids, improve filtration efficiencies and reduce moisture content of the resultant filter cake. Use of a 0.5% sulfurous acid and hydrolytic treatment of sludge at 140C for one hour increased the soluble solids content of the activated sludge by 20%. Concentration of the solubilized extract produced a syrup; 85% of the solids content of the syrup was organic. By TKN estimates, over 20% of these solids were proteinaceous. An amino acid analysis indicated it could be of value as an animal feed, and this was confirmed in rat feeding studies (at a 10% level in the diets) showing an efficiency of food utilization of 42 for the organic molasses as compared to 39 for cane molasses. (Knapp-USGS)
W71-00164

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
George P. Fulton.
Journal of the American Water Works Association, Vol 62, No 9, p 549-554, September 1970. 6 p, 5 fig, 3 tab, 1 ref.

Descriptors: *Waste water treatment, *Droughts, *Estuaries, *Electrodialysis, *Economics, Municipal water, Water costs, Cost analysis, Water quality, Salinity, Saline water, Water resources development, Cost-benefit analysis.
Identifiers: Estuarine water resources.

The major features of design and operation that should be taken into account when electrodialysis (ED) is considered as a method to supplement existing municipal water supplies with water from river estuary sources are reviewed. What is of paramount importance, in considering a river source that is influenced by tidal action, is the specific location of the electrodialysis plant. Such location will influence both the cost of transmission of treated water to the water supply system, and the cost of the treatment, due to variations in raw water quality. In general, an ED facility must be located along a reach of river where a solids content of above 3,000 mg/liter would occur for only limited periods of time, for both normal and drought conditions. At times of drought conditions, the salt front will move farther upstream than during normal periods. In general, the electrodialysis treatment of estuary sources is a reasonable method for supplementing existing water supplies. Each specific situation where ED may be utilized, however, must be evaluated on its own merits, considering all logic alternative methods of supply. (Knapp-USGS)
W71-00214

MANAGING WASTE HEAT WITH THE WATER COOLING TOWER,
Marley Co., Kansas City, Mo.
Joe Ben Dicky, Jr, and Robert E. Cates.
Marley Company, Kansas City, April 1970. p 14, 9 fig.

Descriptors: *Temperature, *Cooling towers, Heat transfer, Costs, Optimization, Waste water treatment, Water pollution control.

One solution to the problem of stream heating by the electric utility industry lies in the use of water cooling towers. Various operating needs include small unit municipals through syndicates operating multiple units aggregating over 5000 megawatts. Operating conditions include constant on-line recirculating, stand-by or 'trim' duty, and once through systems to limit terminal differences. Types of towers discussed are: larger induced draft, forced and assisted draft, natural draft, and the DriTower. Geographical aspects of design and operating problems are outlined. Accompanying the discussion is a presentation of evaluation factors including methods of selection and optimization of both mechanical and natural draft cooling towers. (Upadhyaya-Vanderbilt)
W71-00232

POTENTIAL THERMAL EFFECTS OF AN EXPANDING POWER INDUSTRY: OHIO RIVER BASIN I,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-00235

COOLING TOWERS - A TECHNOLOGICAL TOOL TO INCREASE PLANT SITE POTENTIALS,
Marley Co., Kansas City, Mo.
J. O. Kadel.
American Power Conference, Chicago, April 23, 1970. 15 p, 6 fig, 1 tab.

Descriptors: *Temperature, *Cooling towers, Nuclear powerplant, Evaporation, *Water demand, Waste water treatment.
Identifiers: Fossil fueled plant, Bleed water.

Water demand as related to the water cooling tower system is discussed. For fossil fueled electric generating plants, the waste heat rejected to the cooling water system is on the order of 4,500 BTU per kilowatt-hour of energy generated. A one million kw fossil-fueled plant would require the evaporation of approximately 6,750 gallons of water each minute of operation. A limiting factor for site development is quantity and temperature limits of dependable water supply. The total water demand and proportionate amounts alloted to bleed can readily be compared by examining the curves shown in the paper. Total water demand can vary up to a ratio of 2 to 1 depending on the hardness of the local water. Through careful application of water cooling towers, the power generation potential of plant sites can be increased to a desired level, even if natural water supplies are relatively low. (Upadhyaya-Vanderbilt)
W71-00237

A DISPOSAL SYSTEM FOR AGRICULTURAL WASTE WATERS IN THE SAN JOAQUIN VALLEY OF CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
R. J. Pafford, Jr., and Edgar P. Price.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.407-26.419, Mexico City, 1969. 13 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Drainage water, Drains, Drainage, Irrigated land, *Waste water disposal, Irrigation effects, Subsurface drainage, Waste water, *Disposal, Return flow, Nutrients, Salinity, Water chemistry, Waste water treatment, Water conveyance, Irrigation, Water pollution, Drainage engineering, Drainage systems, Insecticides.
Identifiers: *San Luis Drain (Calif), San Joaquin Valley (Calif), Open drains, Salt removal, Drainage yield.

Events and conditions leading to the construction of the 188-mi-long San Luis Drain to dispose of agricultural waste water from a large irrigated area on the west side of the San Joaquin Valley in California are described. Estimated amounts of drainage water and chemical concentrations for initial and future operation of the drain are presented. Alternative disposal plans and effects of the waste water on the receiving waters in the Sacramento-San Joaquin Delta and the San Francisco Bay area are discussed. Nitrogen concentration is the principal objectionable feature of the waste water. A 3-yr interagency research program to determine the most economical method for removing nitrate-nitrogen from drainage waters is discussed. (USBR)
W71-00263

A METHOD FOR THE TREATMENT OF ANIMAL WASTES TO CONTROL AMMONIA AND OTHER ODORS,
Vineland Labs., Inc., N.J. Research Div.
William Seltzer, Stanley G. Moum, and Tevis M. Goldhaft.
Poultry Science, Vol 48, No 6, p 1912-1918, November 1969. 4 tab, 10 ref.

Descriptors: *Odor, *Ammonia, *Farm wastes, Air pollution, Poultry, Hogs, Cattle, Bactericides.
Identifiers: Paraformaldehyde, Methogen, Odor control, *Manure odors.

Discusses the use of flaked paraformaldehyde for direct treatment of animal wastes to prevent or eliminate the noxious gases from animal quarters. Paraformaldehyde is a mixture of polyoxymethylene glycols containing 90-99% polymerized formaldehyde. Paraformaldehyde liberates formaldehyde gas as it decomposes. For many years ammonia gas has been used to neutralize formaldehyde gas. This work is predicated on using the principal in reverse. The action of the flake paraformaldehyde on the animal wastes was concluded to be both chemical and antimicrobial and these combined actions make it of value in the control of noxious odors and gases emanating as a result of bacterial fermentation. (Miner-Iowa State)
W71-00332

AN IMPROVED METHOD FOR SEPARATE COLLECTION OF URINE, FECES, AND EXPIRATORY GASES FROM THE MATURE CHICKEN,
Agricultural Research Service, Fargo, N. Dak. Metabolism and Radiation Research Lab.
G. D. Paulson.
Poultry Science, Vol 48, No 4, p 1331-1336, 1969. 3 fig, 7 ref.

Descriptors: *Farm wastes, *Urine, *Poultry, Sampling, Carbon dioxide.
Identifiers: Surgical modification, Poultry urine collection, Metabolism cage.

An improved method for surgical modification of the chicken and collection apparatus to facilitate separate collection of urine and feces is described. There was no mortality from surgery, and the modified birds were normal, as evaluated by outward appearance, feed and water consumption, urine and feces excretion, and post examination of sacrificed birds. A metabolism unit and a system for collecting respiratory CO2 from the chicken are also described. (Miner-Iowa State)
W71-00333

HOUSEFLY LARVAE: BIODEGRADATION OF HEN EXCRETA TO USEFUL PRODUCTS,
Agricultural Research Service, Beltsville, Md.
C. C. Calvert, N. O. Morgan, and R. D. Martin.
Poultry Science, Vol 49, No 2, p 588-590, March 1970. 2 tab, 3 ref.

Descriptors: *Farm wastes, *Livestock, *Manure, *Poultry, Insects, Waste treatment, Ultimate disposal, Waste disposal, Odor.
Identifiers: House fly, Hen, Fly eggs, Manure treatment, Waste utilization.

This report presents the results of experiments to establish the concentration of fly eggs that can be used to process hen excreta most efficiently, and a means of separating the house fly pupae from the processed hen excreta and to simplify their collection. Within four days after seeding with house fly pupae the odor of the manure became unobjectionable. After eight days the excreta was reduced to an essentially odorless and friable material. The separated pupae were utilized as a protein source in the diet of growing chicks. (Miner-Iowa State Univ)
W71-00334

AEROBIC TREATMENT OF LIVESTOCK WASTES,
Illinois Univ., Urbana. Agricultural Experiment Station.
D. D. Jones, D. L. Day, and A. C. Dale.
University of Illinois Agricultural Experiment Station Bulletin 737, 1970. 55 p, 26 fig, 4 tab, 45 ref. HEW Grants EC-00245 and EC-00244.

Descriptors: *Oxidation lagoons, *Aeration, *Farm wastes, *Biochemical oxygen demand, Organic matter, Sludge disposal, Oxygenation, Hogs, Cattle.
Identifiers: *Oxidation ditch, *Aerobic lagoon, Livestock waste properties, Biochemical properties, Aerobic treatment, Irrigation system.

This report emphasizes the aerobic method of storage and treatment of livestock wastes primarily becuase of the low level of odors associated with aerobic treatment. An introduction to the theory of aerobic treatment is presented along with several laboratory experiments on swine, dairy cattle, and

poultry wastes. These laboratory experiments verified the use of the aerobic method for livestock wastes. Two methods of aerobic treatment were studied and the results summarized. These were (A) the in-the-building oxidation ditch and (B) the aerobic lagoon (oxidation pond and aerated lagoon). Recommendations are made as to operator convenience, capacity, and design of the different systems. (White-Iowa State)
W71-00339

EFFECT OF MANURE APPLICATION, AERATION, AND SOIL pH ON SOIL NITROGEN TRANSFORMATIONS AND ON CERTAIN SOIL TEST VALUES,
Wisconsin Univ., Madison. Dept. of Soils.
R. J. Olsen, R. F. Hensler, and O. J. Attoe.
Soil Science Society of America Proceedings, Vol 34, No 2, p 222-225, March-April 1970. 2 fig, 2 tab, 10 ref.

Descriptors: *Nitrification, *Denitrification, *Farm wastes, *Aeration, Soil tests, Rates of application.
Identifiers: N recovery, Field moisture capacity, *Soil nitrogen transformations, Soil pH, Nitrate production.

Nitrate production under aerobic conditions was directly related to rate of manure application, period of incubation and soil pH, but was stopped under anaerobic conditions. Average recovery by chemical analysis of N applied as manure to a Plainfield sand at relatively high rates and incubated for 37 weeks was 77% for aerobic conditions and 24% for anaerobic conditions. The addition of manure tended to increase soil pH and the contents of organic N, available P and exchangeable K, Ca, and Mg, particularly at the higher rates. They also increased the field moisture capacity of a Plainfield sand. However, on an acid Ella loamy sand the two highest rates of manure caused a reduction of the values for field moisture capacity, apparently the result of formation of a waxy material that tended to repel water absorption. (Miner-Iowa State)
W71-00341

LIVESTOCK WASTE MANAGEMENT STUDIES-TERMINATION REPORT,
Illinois Univ., Urbana. Agricultural Experiment Station.
D. L. Day, D. D. Jones, and J. C. Converse.
HEW Project No EC-245. July 1970. 97 p, 75 fig, 14 tab, 7 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Chemical oxygen demand, *Odor, Hogs.
Identifiers: *Livestock oxidation ditch, Loading rates, Ditch mixed liquor, Optimum aerobic degradation, Aeration rotors, Operating cost, Feeding value of oxidation ditch solids.

This report deals mainly with results from laboratory tests and field trials of oxidation diches. Different loading rates were studied, and solutions to the problem of foaming were discussed. Most of the work was done with swine although laboratory tests were made with beef and dairy animals. Some research was done to determine the feeding value of oxidation ditch solids. The oxygenation capacity of rotors was discussed. A laboratory study of the minimum aeration for odor control was made using set design criteria. (White-Iowa State)
W71-00342

OXIDATION DITCHES CAN ELIMINATE ODORS, MANURE HANDLING AND POLLUTION,
John Russell.
Farm Journal, Vol 94, No 8, p H-10, H-15, August 1970.

Descriptors: *Farm wastes, *Hogs, *Waste treatment, Activated sludge, Odors, Aeration.
Identifiers: *Oxidation ditch, *Hog confinement, Odor control, Smart Pork Farm, Lawrence (Kans).

The use of oxidation ditches is described in a swine confinement system for 5000 head annually near Lawrence, Kansas. Thousand head finishing buildings have two oxidation ditches each with 4 rotors or wheels in each ditch. Organic matter removal is in excess of 90 percent. Operating costs approximate one dollar per head. Effluent is discharged to holding ponds for evaporation thereby eliminating all manure hauling. (Miner-Iowa State)
W71-00343

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.

Available from NTIS as PB-195 160, $3.00 in paper copy, $0.95 in microfiche. Report No HIT-344, August, 1968. 404 p, 91 tab, 102 fig, 46 ref, 8 append. FWQA Project 11030 DNK 08/68, Contract 14-12-20.

Descriptors: Waste water treatment, *Water reuse, Optimization, *Storm runoff, *Water storage, *Water pollution control, *System analysis, Maryland.
Identifiers: Storm water, Combined sewers, Columbia (Maryland).

This final report covers the work performed by Hittman Associates, Inc. in cooperation with The Rouse Company and the 'new city' of Columbia, Maryland, on the collection, storage, treatment, and reuse of storm water as a means of pollution control and water supply augmentation. A discussion of the work performed in the analysis and optimization of the system; the conceptual designs of potable, sub-potable, and pollution control systems; the conceptual design of a system for controlling pollution using a 'conventional design' approach, the results of the system evaluation and plans for the demonstration of the local storage, treatment, and reuse of storm water. The appendicies to this report include the derivations of the hydrology equations, survey reports on water usage and the public acceptance and legal aspects of reuse, design reports on the 'conventional' and demonstration system, detailed estimates on the cost of the demonstration program, and descriptive information on packaged water treatment plants.
W71-00409

TREATMENT OF WASTE EATER - WASTE OIL MIXTURES.
Armco Steel Corp., Middletown, Ohio.

Available from NTIS as PB-195 161, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402--Price $2.50. 167.13/4; 12010 EZV 02/70. Water Pollution Control Research Series 12010 EZV 02/70, May, 1970. 137 p, 22 tab, 25 fig, 32 ref, 7 append. FWQA Program 12010 EZV, Grant No WPRD-169-01-68.

Descriptors: Waste water treatment, *Industrial wastes, *Emulsions, *Coagulation, Flocculation, *Oil wastes, Flotation, Kinetics, Zeta potential.
Identifiers: *Steel wastes.

Cold reduction of steel strip results in the production of large quantities of waste water containing variable amounts of oil. A five stand tandem cold mill located at Armco Steel Corporation's Ashland, Kentucky Works produces 200 to 500 gpm of waste water containing 400 to 4,000 ppm of oil. The COD of the waste varies from 400 to 20,000 ppm. A treatment process and facility was developed, constructed, and demonstrated, on full scale, for the treatment of cold mill wastes. The treatment process utilized chemical coagulation to break the emulsions. The chemicals employed included alum, lime, clay and organic polyelectrolyte. The process consisted of the following treatment steps; equalization, chemical addition and rapid mixing, flocculation, and dissolved air flotation. A number of treatment variables were studied in the laboratory and in the field in order to establish process kinetics and otpimum treatment efficiency. Zeta potential, streaming current, and particle size distribution were used in laboratory studies to describe the effect of the following variables in process kinetics; acid number, initial oil concentration, type of emulsifier, chemical dosage, order of chemical addition, reaction time, and final pH. Based on these studies, an hypothesis of the emulsion breaking mechanism was proposed. Oil, COD, and turbidity were used in field studies to establish the effect of the following variables on treatment efficiency; chemcial concentration, order of chemical addition, chemical mixing time, flocculation mixing time and speed, and air flotation time and recirculation rate. Based on these studies, design criteria and operating costs for this process were presented.
W71-00410

FEASIBILITY OF A STABILIZATION-RETENTION BASIN IN LAKE ERIE AT CLEVELAND, OHIO.
Havens and Emerson, Cleveland, Ohio.

Available from NTIS as PB-195 083, $3.00 in paper copy, $0.95 in microfiche. Report, May, 1968. 145 p, 22 tab, 34 fig, 38 ref, 3 append. FWQA Project 11020---05/68, Contract No 14-12-27.

Descriptors: Lake Erie, Waste water treatment, *Oxidation lagoons, Ohio, Retention, Water storage, *Settling basins, Costs, Evaluation, Pollution abatement.
Identifiers: Cleveland (Ohio), *Stabilization-retention basins, *Collection systems.

A feasibility study was conducted of a large stabilization-retention basin to constructed in Lake Erie at Cleveland, Ohio. The stabilization is viewed as a possible alternative to separation of a combined sewer system. The proposed basin would treat flows from a number of large combined sewer overflows, from several polluted streams, and effluent from a large secondary wastewater treatment plant. Treatment would consist of bio-oxidation, sedimentation, stabilization and disinfection. A shoreline collection system is included to convey flows to the basin. The chemical, biological, physical and structural aspects of the proposed basin were studied, and the probable benefits to water quality and the effectiveness of the basin as a treatment device were evaluated. Estimates of cost of the basin and collection system were prepared, and it was concluded that the stabilization basin would provide a higher degree of pollution abatement than would separation of sanitary and storm sewers, at about one-third the cost.
W71-00411

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWER OVERFLOWS - BUCYRUS, OHIO.
Burgess and Niple Ltd., Columbus, Ohio.

Available from the NTIS as PB-195 162, $0.95 in microfiche. Also for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402--Price $2.00. 167.13/4; 11024FNK11/69. Water Pollution Control Research Series 11024 FKN 11/69, November 1969. 197 p, 30 tab, 67 fig, 59 ref. FWQA Project 11024 FKN, Contract No 14-12-401.

Descriptors: Drainage, Hydrographs, Infiltration, *Water pollution control, Interception, Sewers, *Overflow, Urbanization, Ohio, *Pollution abatement, Waste water treatment, Storm runoff.
Identifiers: *Combined sewers, *Interceptor sewers, *Urban runoff, Bucyrus (Ohio), *Sewer overflows.

This report contains the results of a detailed engineering investigation and comprehensive techni-

cal study to evaluate the pollutional effects from combined sewer overflows on the Sandusky River at Bucyrus, Ohio and to evaluate the benefits, economics and feasibility of alternate plans for pollution abatement from the combined sewer overflows. The City of Bucyrus is located near the upper end of the Sandusky River Basin which is tributary to Lake Erie. Bucyrus has an incorporated area of about 2,340 acres, a population of 13,000, and a combined sewer system with an average dry weather waste water flow of 2.2 million gallons per day. A year long detailed sampling and laboratory analysis program was conducted on the combined sewer overflows in which the overflows were measured and sampled at 3 locations comprising 64% of the City's sewered area and the river flow was measured and sampled above and below Bucyrus. The results of the study show that any 20 minute rainfall greater than 0.05 of an inch will produce an overflow. The combined sewers will overflow about 73 times each year discharging an estimated annual volume of 350 million gallons containing 350,000 pounds of BOD and 1,400,000 pounds of suspended solids. The combined sewer overflows had an average BOD of 120 mg/l, suspended solids of 470 mg/l, total coliforms of 11,000,000 per 100 ml and fecal coliforms of 1,600,000 per 100 ml. The BOD concentration of the Sandusky River, immediately downstream from Bucyrus, varied from an average of 6 mg/l during dry weather to a high of 51 mg/l during overflow discharges. The suspended solids varied from an average of 49 mg/l during dry weather to a high of 960 mg/l during overflow discharges. The total coliforms varied from an average of 400,000 per 100 ml during dry weather to a high of 8,800,000 per 100 ml during overflow discharges. Various methods of controlling the pollution from combined sewer overflows are presented along with their degree of protection, advantages, disadvantages and estimates of cost. The methods presented include (1) COMPLETE SEPARATION, (2) interceptor sewer and lagoon system, (3) stream flow augmentation, (4) primary treatment, (5) chlorination, and (6) offstream treatment. It was concluded that the most economical method of providing a high degree of protection to the Sandusky River is by collecting the combined sewer overflows with a large interceptor and using an aerated lagoon system to treat the waste loads from the overflows.
W71-00412

MICROWAVE IRRADIATION OF POTATO WASTE WATER,
Manitoba Univ., Winnipeg. Dept. of Electrical Engineering.
M. A. K. Hamid, W. M. Boerner, and S. C. Tong.
Available from NTIS as AD-711 247, $3.00 in paper copy, $0.95 in microfiche. Journal of Microwave Power, Vol 5, No 1, p 44-46, Feb 1970.
Identifiers: *Water pollution, *Potatoes, *Microwaves, Water pollution, Food, Control, Bacteria, Canada, Potato processing, *Food processing, *Water pollution control equipment, *Microwave sterilization.

Preliminary experiments designed to investigate the sterilization of polluted potato-waste water suggest that microwaves may stimulate the growth of aerobic bacteria, which have a high oxygen demand, and may on the other hand reduce the number of photosynthetic bacteria. These observations have yet to be confirmed with further experimentation as the study continues.
W71-00417

WATER AND SEWER REPORT.
Essex County Planning Board, Belleville, N.J.

Available from NTIS as PB-192 356, $3.00 in paper copy, $0.95 in microfiche. Planners Associates, Inc, Newark, NJ, December 1969. 146 p.
Identifiers: *Management planning, *New Jersey, Economics, *Water suppl)ies, Urban planning, *Sewage, Urban areas, Statistical data, Wastes (Sanitary engineering, Costs, Water pollution, Chlorine compounds, Programming (Computers), Mathematical models, Maps, *Essex County (N J), Area planning and development, Water quality, Water analysis, Sewage treatment.

The report inventories all public and private water and sewer systems in Essex County and the 22 municipalities therein. It then forecasts the 1990 demand for water and sewer services and formulates a plan meeting these demands. The costs for implementing all elements of the recommended plan are included in the capital improvements program.
W71-00420

PRELIMINARY REGIONAL PLAN FOR WATER AND SEWERAGE FACILITIES.
East-West Gateway Coordinating Council, East St. Louis, Ill.

Available from NTIS as PB-192 093, $3.00 in paper copy, $0.95 in microfiche. September 1969. 79 p.
Identifiers: *Sanitary engineering, *Urban areas, *Urban planning, *Missouri, *Management planning, *Illinois, Water supplies, Sewage, Population, Advanced planning, Statistical data, Problem solving, East West Gateway area, *Saint Louis (Missouri), Stormwater.

The report discusses the major water supply, sewage treatment, and storm water problems in the area. Separate sections deal with water supply and an evaluation of water plant capacities, with sewage treatment problems and ratings of treatment plants according to present and future abilities to meet existing standards, and with major storm water problems.
W71-00421

WATER AND SEWER FINANCIAL PLAN.
Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga.
For primary bibliographic entry see Field 06C.
W71-00422

INDUSTRIAL WATER USAGE AND WASTE DISPOSAL IN THE IRON AND STEEL INDUSTRY,
Iscor Works, Vanderbijl Park (South Africa).
S. Erasmus.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 9 p, 3 tab.

Descriptors: *Water utilization, *Water reuse, Effluents, Steel, Industrial wastes, Water pollution, Recirculated water, Reclaimed water.
Identifiers: *Iron and Steel Industry, South Africa.

Emphasis is laid on the correct interpretation of the often abused water usage terms like 'consumption' and 'application rate'. Consumption losses in a steel mill amount to 45 to 50% of daily make-up which could probably only be reduced by the introduction of air cooled units. The need for superior quality water for specific applications is emphasized and that the most effective use is based on the cascading and inplant circulating systems. Although recirculation systems are prerequisites for optimum water utilization it does not necessarily decrease consumption use. Such practice often leads to the same weight of pollution in smaller discharges which could result in unacceptable quality effluents. This discourages intensive reuse of water. (Selby-Texas)
W71-00424

PLANNING AND CONSTRUCTION OF WASTE WATER RECLAMATION SCHEMES AS AN INTEGRAL PART OF WATER SUPPLY,
G. J. Stander, and A. J. Clayton.
1970 Conference of the Institute of Water Pollution Control, Cape Town, South Africa (Southern African Branch), March 16-20, 1970. Preprint, 11 p, 2 tab, 4 fig.

Descriptors: *Water consumption, *Water reuse, Effluents, Costs, Waste water treatment, Tertiary treatment.
Identifiers: *South Africa, Internal Reuse.

Statistics presented indicate South Africa is heading for a substantial water shortage on a basis of current usage technology. This forces an acceptance of the fresh water supply, beneficial use and reuse of water, waste water management, and reclamation and the control of pollution are inseparable components in a broad water conservation plan. Reuse of water and reclamation of effluents arising from unit processes in a factory can result in a saving on water consumption of between 50 and 90%. A table compares water requirements of several industries before and after reclamation and reuse. In industrialized urban areas, which account for only about 17% of current daily water usage, 60 to 100% of water intake reaches sewage purification facilities, so it is economically and strategically sound to exploit purified effluents. Predicted water consumption and production patterns are discussed along with the total treatment costs. It will be more advantageous in the future to subsidize local authorities to reclaim their effluents than to develop new water schemes involving the piping of water over long distances. (Selby-Texas)
W71-00427

THE LOCAL GOVERNMENT PRESPECTIVE ON WASTE WATER,
E. J. Hall.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 24 p, 4 fig, 3 tab, 12 ref.

Descriptors: *Water Resources, *Political aspects, Local governments, Waste water disposal, Water pollution, Reuse, Waste water treatment.
Identifiers: *South Africa.

By the year 2,000 the water demand in the Republic of South Africa will just about equal the total water supply from all natural sources. But due to geographical distribution of the areas of supply and demand, equitable allocation of all stored water to the demand centers would be impractical. Prime supply as a general rule will be inadequate in developed regions by this time. The dimensions of the problem of waste water control are not fully appreciated even by professional men in local government directly concerned with waste water purification, and there is an urgent need for forward planning. It is of the utmost importance that the State and its departments, which have the ultimate responsibility, should understand in full the dilemma of the local authority. A sympathetic and understanding cooperation between these two levels of government is essential if success is to be achieved. (Selby-Texas)
W71-00428

OBJECTIVES OF WATER POLLUTION CONTROL AND THE PROBLEMS OF THEIR ACHIEVEMENT,
G. Mann.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 14 p.

Descriptors: *Water pollution control, *Legislation, Local government, Reuse, Waste water treatment.
Identifiers: *South Africa.

The basis of pollution control treatment as it affects industrial effluents should be one of prevention, and in this respect every endeavor is brought to bear on industrialists local governments, provincial authorities and state departments to make provision for control methods, physical or chemical or both, at their source. Besides control by legislation there are the ethical aspects to be considered as well. Industrialists must also be concerned for the good of South Africa to do all that is in their power

as well as in their interests to exercise the maximum control over water they use, the discharge and disposal of the industrial effluents, and the reuse of purified effluents. (Selby-Texas)
W71-00429

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
S. S. Morris.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 44 p, 19 ref.

Descriptors: *Waste treatment, *Water Resources, Reuse, Waste disposal, Waste water treatment, Water management (Applied).
Identifiers: *South Africa.

The history is reviewed of the development of water and waste management in the Cape Town metropolitan area of South Africa beginning with the occupation of that country by the white races. The country's water supply is discussed including the role of reused sewage and industrial effluents as a water resource. Liquid and solid wastes disposal systems are also discussed including the various pollution investigation and control organizations. (Selby-Texas)
W71-00431

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.

Available from NTIS as PB-195 168, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series DAST-5, 11023 FDD 03/70, March 1970. 69 p, 19 tab, 24 fig, 3 append. FWQA Program 11023 FDD, Contract 14-12-128.

Descriptors: *Screens, *Overflow, *Sewage treatment, Waste water treatment, Storm runoff, Cost analysis, Evaluation, Cost comparisons, Treatment facilities.
Identifiers: *Rotary screens, *Combined sewers, Sewer overflows.

The objective of this study was to determine the feasibility, effectiveness, and economics of employing high-rate, fine-mesh screening for primary treatment of storm water overflow from combined sewer systems. The final form of the screening unit stands 63 inches high and has an outside diameter of 80 inches. The unit is fed by an 8-inch pipe carrying 1700 gpm (122 gal/min/ft2) which is distributed to a 60-inch diameter rotating (60 rpm) stainless collar screen having 14 square feet of available screen area and a 165 mesh (105 micron opening, 47.1 percent open area). The screen backwashed at the rate of 0.235 gallons of backwash water per 1000 gallons of applied sewage. Based on final performance tests run on dry-weather sewage, the unit is capable of 99 percent removal of floatable and settleable solids, 34 percent removal of total suspended solids and 27 percent removal of COD. The screened effluent is typically 92 percent of the influent flow. On the basis of a scale-up design of a 25 mgd screening facility, the estimated cost of treatment is 22 cents/1000 gallons. No finite cost comparisons were made with other treatment methods; however, when compared to conventional primary sedimentation, the selection of a screening facility as a treatment method is dependent on the value and availability of land, the design capacity of the treatment facility, the character of rainfall and runoff, and the available means of disinfection. It was observed that the proposed screening facility required 1/10 to 1/20 the land required by a conventional primary treatment plant.
W71-00476

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.
For primary bibliographic entry see Field 05G.
W71-00479

MULTIPLE PHASE EJECTOR PILOT PLANT,
Kaye (Joseph) and Co., Inc., Cambridge, Mass.
For primary bibliographic entry see Field 03A.
W71-00482

PRELIMINARY WASTE WATER REPORT FOR THE OUTER AREA.
Northeastern Illinois Planning Commission, Chicago.

Financed in part with a planning grant from the HUD under Section 701 of the Housing Act of 1954. July 1970. 208 p, 37 fig, 48 tab, 146 ref.

Descriptors: *Waste water treatment, *Waste water, *Water quality control, *Water management, *Water pollution, *Illinois, *Water pollution control, *Water quality act, *Regional analysis, *Planning, *Urbanization, *Local governments, *Treatment facilities, Waste water pollution, Industrial wastes, Sewers, Municipal wastes, Construction costs, Evaluation, Analysis.
Identifiers: *Northeastern Illinois, Metropolitan planning, Agricultural wastes, Physiography, Comprehensive plan.

This preliminary report presents information on existing waste water treatment facilities in four of the six counties comprizing the Northeastern Illinois Metropolitan Area. It also summarizes the estimated future requirements and costs for waste water treatment in each county to the year 2,005. The counties include all of McHenry, Kane and Will counties and that portion of Lake County that is not served by the North Shore Sanitary District. Statistical and technical data are presented on each county to describe population trends and estimates, land use, topography, drainage, water supply, climate, and exisiting waste water disposal facilities, problems and alternative solutions. In some cases, proposed solutions involve the creation of a county public works department or county public health department to acquire, improve, construct and operate county treatment facilities or to provide advisory service to independently operated facilities. Other solutions, involving subregional or district waste water agencies and continuation of operations of existing plants by individual municipalities and industrial plants, are also evaluated. The relationship of these possible solutions to the comprehensive general plan of the entire region is discussed. The appendix includes the Illinois Water Quality Standards and sections on animal wastes and nutrients. The publication is intended for review purposes and is not considered to be in its final form. (See also W71-00486) (Poertner)
W71-00485

PRELIMINARY WASTE WATER PLAN FOR THE INNER AREA; SUPPLEMENT NO. 1, RECOMMENDED PLAN FOR DUPAGE COUNTY.
Northeastern Illinois Planning Commission, Chicago.

Financed in part with planning grant from the HUD under Section 701 of Housing Act of 1954. July 1969. 74 p, 11 fig, 10 tab, 11 ref.

Descriptors: *Waste water treatment, *Evaluation, *Analysis, *Waste water, *Water quality, *Water management, *Water pollution, *Illinois, *Water pollution control, *Urbanization, *Planning, *Treatment facilities, *Local governments, Sewers, Municipal wastes, Waste water pollution.
Identifiers: *Northeastern Illinois, *DuPage County, Metropolitan planning, Comprehensive plan.

Four proposed plans are analyzed for providing waste water treatment and disposal facilities to meet the increasing needs of DuPage County, the most rapidly growing county in Illinois. It lies immediately west of Cook County. The factors that are considered in the analyses and comparisons illustrate thoughtful and far reaching evaluation of alternatives. The study exemplifies some philosophies that should be considered by those planning the waste water facilities for other rapidly growing counties. Two of the proposed systems included a single treatment plant together with extensive systems of large diameter interceptor sewers. Another plan proposed eight treatment plants, and another proposed eleven. Each of the latter two systems involved less extensive systems of smaller diameter interceptor sewers. In addition to capital, operating and maintenance costs, the comparisons included consideration of water reuse, the loss of flood plain storage to urbanization when sewers are provided, the relationship of proposed sewer routes to existing mass transportation routes, the potentials for staged construction, urgan drainage potentials, relationships of existing forest preserves, opportunities for open space acquisitions, and financing, administrative and management opportunities and problems. The eight plant system, under County management, was recommended. This publication is intended for review purposes. (See also W71-00485) (Poertner)
W71-00486

5E. Ultimate Disposal of Wastes

DISPOSAL OF RADIOACTIVE WASTES FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES, 1969,
Naval Ship Systems Command, Washington, D.C.
J. J. Mangeno, and M. E. Miles.
Radiological Health Data and Reports, Vol 11, No 8, p 373-377, August 1970. 5 p, 3 tab, 9 ref.

Descriptors: *Radioactive waste disposal, *Ships, *Nuclear wastes, *Monitoring, *Harbors, Nuclear reactors, Water pollution sources, Water pollution control.
Identifiers: Nuclear-powered ships, U. S. Navy.

This report summarizes data on disposal of radioactive wastes from U. S. Naval nuclear-powered ships and their support facilities and summarizes results of environmental monitoring performed to confirm adequacy of waste disposal limits and procedures. The total long-lived radioactivity in liquid waste discharges associated with operation and maintenance of Naval nuclear-powered ships totaled 0.05 curies in 1969 for all harbors. This is comparable to the average of 0.2 curies discharged per year during the preceding 3 years for all harbors and is less than the average of 4 curies reported discharged per year during the preceding 5 years. No increase in radioactivity above normal background levels has been detected in harbor water. Discharges of liquid wastes from U. S. Naval nuclear-powered ships have not caused a measurable increase in the general background radioactivity of the environment. Low-level cobalt-60 radioactivity is detectable in localized areas of harbor bottom sediment around a few piers at operating bases and shipyards where maintenance and overhaul of Naval nuclear-powered ships have been conducted over a period of several years. (Knapp-USGS)
W71-00030

DEEP-WELL INJECTION (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
T. J. Tofflemire.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1231-1235, June 1970. 35 ref.

Descriptors: *Industrial wastes, *Deep-wells, *Injection wells, Wells, Waste water treatment, Waste disposal, Geology.

The use of deep wells for disposal of industrial waste has grown rapidly over the last 20 years. In

1950 there were many salt-brine disposal wells but only a few disposal wells for industrial wastes. In 1967 there were 40,000 salt-brine disposal wells and 110 wells for other wastes. It is suggested that in some cases deep-well injection has achieved a complete solution to the pollution problem and 100% BOD removal. A discussion of the legal implications, legislation and regulations of deep-well injection is discussed. Geological considerations are discussed from the standpoint of isolating the waste from fresh groundwater and from other natural resources such as gas, oil and coal. Abandoned wells, faults, and geological conditions must be considered when planning a disposal well site. It is also necessary to consider earthquake activity when planning a deep-well. It is conceivable that under certain conditions an improperly located deep-well might trigger an earthquake. Technical considerations such as operational problems from clogging and corrsion are mentioned. Numerous case histories are discussed from several industries which utilize deep-well injection disposal methods. (Hancuff-Texas)
W71-00136

CITY OF NEW BRUNSWICK V BOROUGH OF MILLTOWN (MUNICIPAL DISPOSAL OF WASTES).
For primary bibliographic entry see Field 06E.
W71-00328

FEEDING VALUE OF CATTLE MANURE FOR CATTLE,
Auburn Univ., Ala. Dept. of Animal Science.
W. Brady Anthony.
Journal of Animal Science, Vol 30, No 2, p 274-277, 1970. 6 tab, 14 ref.

Descriptors: *Farm wastes, *Manure, Cattle, Feeds, Reuse.
Identifiers: *Cattle manure, Manure feeding, Manure utilization, Feed supplement.

The objectives were to reappraise the feeding of manure-containing rations to fattening cattle and determine if cooking the manure improved it's feeding value. Rations containing wet cattle manure were readily consumed by fattening steers and these rations supported gain essentially equal to comparable cattle fed feeds without manure. Cooking or washing manure before mixing it with concentrate for feeding did not improve its feeding value. Carcass data were similar for manure-fed and other cattle. Wet manure collected daily per yearling steer was about 13.5 kg. (3.12 kg. dry matter) and about 6.6 kg. (1.52 kg. dry matter) was consumed daily. The digestibility data do not clearly indicate effective use of either manure energy or manure crude protein. However the data show that manure did not impair digestibility and actually saved concentrate dry matter used per unit of gain. This indirect evidence strongly suggests that manure was utilized to an appreciable degree for productive purposes. Feeding manure with concentrate did not completely alleviate waste disposal problems. Only about one-half of the manure collected daily was fed. The remainder of the daily excretion had to be disposed of elsewhere. (Miner-Iowa State)
W71-00329

EFFECTS OF SAN DIEGO'S WASTE WATER DISCHARGE ON THE OCEAN ENVIRONMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05C.
W71-00347

DEEP-SEA DISPOSAL OF LIQUID AND SOLID WASTES,
Dillingham Environmental Co., Honolulu, Hawaii.
David D. Smith, and Robert P. Brown.
Industrial Water Engineering, Vol 7, No 9, p 20-24, September 1970. 5 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Waste disposal, *Industrial wastes, *Solid wastes, *Radioactive waste disposal, *Oceans, Sludge disposal, Poisons, Explosives, Acids.
Identifiers: Waste disposal sites (Oceans).

The current status of oceanic disposal of liquid and solid wastes from 20 U.S. cities is summarized. In 1968, 48 million tons were disposed of at sea at an estimated cost of $29 million. About 120 disposal areas were identified. (Knapp-USGS)
W71-00349

MARINE DISPOSAL OF PETROLEUM REFINERY EFFLUENTS,
B. F. Steere.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 9 p, 7 fig, 5 ref.

Descriptors: *Oil wastes, *Oily water, *Disposal, *Sea water, Ocean currents, Surge tank, Retention, Industrial wastes.
Identifiers: South Africa, Oil separator.

Following the erection of an oil refinery on the South African coast, a system was designed for effluent treatment and disposal. Oily effluent water was passed through an oil separator with surge and retention basins, and then discharged by pipeline into the bay, at least 1,500 feet beyond the high water mark. A diffuser at the end of the line was to ensure adequate dispersion and dilution of the effluent with sea water and also prevent filting of the orifices. The design and operation of the system has proven successful. The system is capable of reducing undesirable constituents in the effluent, and of dispensing it in the sea, to the extent that little or no effect is noticeable on the environment. No complaints have been received from the public. (Selby-Texas)
W71-00423

PRELIMINARY REPORT ON GEOHYDROLOGIC EXPLORATION FOR DEEP WELL DISPOSAL OF EFFLUENT, WAIMANALO SEWAGE TREATMENT PLANT, OAHU,
Hawaii State Dept. of Land and Natural Resources, Honolulu. Div. of Water and Land Development.
Daniel Lum.
Department of the Land and Natural Resources, Circular C 54. 14 p, 6 fig, 1 tab.

Descriptors: *Effluents, *Sewage disposal, *Deep wells, Hydrology, Costs, Injection, Discharge measurement, Hawaii, Hydrogeology, *Exploration.

Because of a high estimated cost of constructing an ocean outfall sewage effluent disposal system, the Hawaiian Department of Land and Natural Resources decided to investigate effluent disposal utilizing deep wells. The various geohydrologic investigations were completed over a three-year period in three phases. First, a preliminary injection test utilizing an existing non-used well. Second, subsurface geohydrologic exploration consisting of drilling, coring, and testing eight Nx-size test holes. Depths varied from 50 to 450 feet and a total of 2,200 feet of core drilling and hydrologic testing were accomplished. Third, drilling and testing of three-15 inch diameter disposal wells within the sewage treatment plant site. Test results show that the three 15-inch disposal wells have a minimum capacity of 14.0 MGD (million gallons per day), compared to the present 1.1 MGD and the ultimate 2.2 MGD EFFLUENT FLOW DESIGNED FOR THE Waimanalo sewage treatment plant. Also, the 14.0 MGD capacity of the wells is twice the 7.0 MGD design peak flow of the treatment plant. (Selby-Texas)
W71-00430

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
For primary bibliographic entry see Field 05D.
W71-00431

5F. Water Treatment and Quality Alteration

HYDROBIOLOGICAL PROPSPECTIVES OF THE MEURTHE: MINERAL POLLUTION AND ALGAL VEGETATIONS (IN FRENCH),
Laboratoire de Biologie Vegetale, Nancy (France).
Jean-Francois Pierre.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 17, Serie D, p 2101-2102, 1970. 3 ref.

Descriptors: *Water treatment, *Chlorination, *Algal control, Rivers, Water pollution effects, Algae, Diatoms.
Identifiers: Rhine-Maas Basin (France), Meurthe River (France), Cladophora, Phormidium, Oscillatoria, Oedogonium.

One of the flowing cultures contained water of the River Meurthe with chlorine ion concentration in the proximity of 37 milligram/liter. In another culture the concentration of chlorine was increased to 760 milligram/liter. Inocula included Cladophora glomerata, Oedogonium spp, Phormidium tenue, Oscillatoria spp, and numerous diatoms. The increased concentration of chlorine failed to influence significantly the algal population thus demonstrating considerable ecological plasticity of these organisms. The results suggested that the concentration of 800 milligram/liter of chlorine ions in the River Meurthe would not produce a harmful suppression of algal growth. (Wilde-Wisconsin)
W71-00099

BEVERLY HILLS WATER DEPARTMENT SOLVES ALGAE PROBLEM WITH KMnO-sub-4,
Beverly Hills Municipal Water Dept., Calif.
Mary Jo Witt.
Water and Sewage Works, Vol 115, p 400-403, 1968. 2 fig, 6 photos.

Descriptors: *Potable water, *Water quality control, *Algae, Copper sulfate, Chlorine, Wells, California.
Identifiers: *Potassium permanganate, Beverly Hills (Calif).

Beverly Hills (California) operates two lime softening and filtration plants for their well water. Plants No 1 and No 2 treat an average of 5.5 mgd and 2.5 mgd, respectively. In March 1963, a 900,000 gal sedimentation basin in Plant No 1 was replaced by a 250,000 gal basin. Copper sulfate and chlorine had controlled algae and bacterial growths in the old basin but converted algae and bacteria to a greenish-black tar-like scum in the new basin. In July 1964, a 1.8 milligram/liter dose of potassium permanganate was added to the basin along with chlorine and copper sulfate resulting in noticeable improvement within a day or so; continued treatment eliminated the growth. For maximum contact, potassium permanganate was fed into the pump discharge line at the furthest well. Since starting potassium permanganate treatment, copper sulfate application was eliminated; shutdowns for clean-out are necessary only every 9-12 months, and there is practically no algae in the settling basin. During the summer and fall large pieces of algae would break loose from the clarifier and basin walls in Plant No 2. In October 1965, a 1.2-1.5 milligram/liter continuing dose of potassium permanganate, fed to the well farthest from the plant, freed the growth from the basin walls. (Haskings-Wisconsin)
W71-00110

DIATOMITE FILTRATION SLUDGE DISPOSAL (SUBCOMMITTEE PROGRESS REPORT),
American Water Works Association, New York. Water Quality Div.
E. R. Baumann, J. Stewart Brown, and Charles H. Lawrence.
Journal of the American Water Works Association, Vol 62, No 8, p 507-509. 1 tab.

Descriptors: *Sludge, *Waster treatment, *Filtration, *Diatonacious earth, Lagoons, Dewatering sewage disposal, Chemicals.
Identifiers: Solids, Reuse, Land disposal.

There is even less published information on practices with disposal of diatomite filtration plant wastes than with conventional filtration plant process wastes. For filtration wastes the chief available experience has been with settling lagoons which have been more or less for diatomite treatment plants. It is hoped that the plant survey currently being conducted will reveal additional information about existing plants. It is hoped that assistance will be available from other organizations. In general it appears that the overall magnitude of the problems for disposal of process wastes from water filtration by diatomite and by conventional facilities are quite close. Each has its own inherent advantages and disadvantages. Diatomite filtration involved substantially less total volumn of liquid waste than does conventional. For low turbidity applications which are those normally chosen for diatomite treatment the total dry solids wasted may not be much greater, if at all, than that produced by coagulation sludge from a conventional filtration plant of the same through put. The porosity of diatomite wastes make for relatively easy dewatering, however, the abbrasive nature of the filter aid may make handling difficult. (Hancuff-Texas)
W71-00125

HIGH-RATE FILTER EFFICIENCY,
Contra Costa County Waste District, Calif.
W. Leslie Harris.
Journal of the American Water Works Association, Vol 62, No 8, p 515-519, August 1970. 2 fig, 2 tab, 7 ref.

Descriptors: *Filtration, *Water treatment, *Operations, Filters, Water quality, Head-loss.
Identifiers: Loading, Backwash, Conditioning.

An experimental programme made prior to the construction of a new water treatment plant for the Contra Costa County District indicated that the feasibility of upping the capacity of filtration some 70% from 6 to 10 gpm/sq ft while applying a water of higher turbidity to the filters. When the plant was constructed in May 1968 it demonstrated an efficiency three times that of the former main plant with dual media filters and nearly 8 times the efficiency of the same plant back in the days of straight sand filtration. In the course of more than 400 runs with an experimental filter it was found that a conditioned filter accepted surges without passage of previously deposited material. A filter may be conditioned to augment straining through the addition of small amounts of a polymer to the backwash water during the backflow time. Conditioning was developed using anthracite sand filters which also enabled longer runs at higher rates. Experimental work also indicated that a substantial air lift introduced just above the expanded bed removed fines which otherwise remained above the lifted bed. Garnet, a fine heavy material, was eliminated because of some hazard of its downward migration to the supporting gravel and its tendency to result in the fountain effect when localized high flows occurred. (Hancuff-Texas)
W71-00129

WATER AND HEALTH--ARE WE CONCERNED ENOUGH,
Pennsylvania Dept. of Health, Harrisburg. Div. of Sanitary Engineering.
Walter A. Lyon.
In: Water Resources Bulletin, Vol 6, No 1, February 1970, p 72-77. 12 ref.

Descriptors: *Water quality control, *Public health, *Water pollution, *Water pollution sources, Pesticide residues, Viruses, Chemicals, Legal aspects, Public rights, Social aspects, Environmental effects, Attitudes.
Identifiers: *Environmental policy.

From an historical point of view, man's concern about the health and protection of water supply is the history of the dramatic reduction in acute communicable diseases due to water-borne micro-organisms. Now that these have been essentially eliminated, there has been a great reduction in concern by scientists and the medical profession with the health aspects of contaminated water. This, in spite of the fact that many concerned people and national advisory groups have reminded us that an increasing number of possible chemical and other hazards find their way into our water supplies and expose human populations to contaminants at low concentration levels without reliable knowledge as to their health effects. Too little research is being done on the health effects of chemicals, pesticides, and viruses. The fact that large populations are being exposed to these possible hazards raises legal and public policy questions. Persons who are largely ignorant of the possible harm of these substances are being exposed to them without consent. Often low level exposure to environmental contaminants is not known or not discovered until considerable time has passed. This raises the question concerning the burden which should be imposed on industry and others who introduce new substances in the environment. The best approach in solving this problem is to prohibit the new substance from being introduced into the environment until it has been shown by reliable studies that even low level exposure is not likely to harm human health. (Marriott-Chicago)
W71-00312

WATER AND SEWER REPORT.
Essex County Planning Board, Belleville, N.J.
For primary bibliographic entry see Field 05D.
W71-00420

PRELIMINARY REGIONAL PLAN FOR WATER AND SEWERAGE FACILITIES.
East-West Gateway Coordinating Council, East St. Louis, Ill.
For primary bibliographic entry see Field 05D.
W71-00421

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
For primary bibliographic entry see Field 05D.
W71-00431

RAPID PROCEDURES TO MONITOR WATER FOR POTABILITY,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
For primary bibliographic entry see Field 05A.
W71-00455

5G. Water Quality Control

CLEAN WATER FOR THE 1970'S--A STATUS REPORT.
Federal Water Quality Administration, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.50. Federal Water Quality Administration Status Report, June 1970. 80 p.

Descriptors: *Water pollution control, *Water quality control, *Water quality act, Legislation, Water law, Quality control, Abatement, Governments, Water quality.
Identifiers: Federal Water Quality Administration.

Since 1966, the primary responsibility for carrying out the Federal programs in water pollution has rested with the Federal Water Pollution Control Administration. Passage of the Water Quality Improvement Act of 1970 resulted in a new name for the agency, the Federal Water Quality Administration (FWQA), which stresses the more positive aspects of the program. The purpose of this first annual progress report is to provide a groundwork for understanding the nature of the Federal and State water pollution control programs, to detail the progress which has been made during the first year of the Nixon Administration, and to assess the measures which will be required to fulfill the challenge of the 1970's. An important part of this assessment is the impact of significant new water pollution control legislation. (Knapp-USGS)
W71-00011

DISPOSAL OF RADIOACTIVE WASTES FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES, 1969,
Naval Ship Systems Command, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-00030

POOVEY V CITY OF HICKORY (CITY'S LIABILITY FOR WATER POLLUTION RESULTING FROM SEWAGE DISPOSAL),
For primary bibliographic entry see Field 06E.
W71-00162

A STUDY OF THE DISPERSION AND FLUSHING OF WATER-BORNE MATERIALS IN THE NORTHWEST BRANCH OF BALTIMORE HARBOR, AND THE RELATIONSHIP BETWEEN THESE PHYSICAL PROCESSES AND THE WATER QUALITY OF THE INNER HARBOR,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 05B.
W71-00200

EXTENT OF BRACKISH WATER IN THE TIDAL RIVERS OF MARYLAND,
Geological Survey, Towson,Md.
For primary bibliographic entry see Field 02L.
W71-00215

THE ROLE OF HIGHER WATER PLANTS IN THE SELF-PURIFICATION OF OIL-POLLUTED RIVERS,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 05B.
W71-00223

WATER SUPPLY AND WATER POLLUTION CONTROL-APPENDIX D TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio. Ohio Basin Region.

Report on Development of Water Resources in Appalachia published in 25 Volumes. Federal Water Pollution Control Administration Report, Vol 19 of 25 Vol, Append D, March 1969. 379 p.

Descriptors: *Water supply, *Water pollution control, *Water resources development, *Appalachian Mountain region, Water pollution sources, Water pollution treatment, Waste water disposal, Industrial wastes, Acid mine water, Water utilization, Surface waters, Groundwater.
Identifiers: Appalachian redevelopment.

Appendix D, 'Water Supply and Water Pollution Control' of the Report for Development of Water Resources in Appalachia furnishes information on water supply and water pollution control needs in and adjacent to the Appalachian region. Included are a general appraisal of present and future water supply and water pollution control needs, and the ways and means of satisfying these needs. The appendix also includes detailed discussions of water supply and water quality control needs that can be satisfied from selected reservoir projects that are proposed for inclusion in the Appalachian Plan for

Water Resources Development. An index for the entire report with its 9 appendices is included. (Knapp-USGS)
W71-00225

EFFECT OF SOIL WATER STRESS AND SOIL TEMPERATURE ON TRANSLOCATION OF DIURON,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02I.
W71-00226

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
For primary bibliographic entry see Field 05B.
W71-00231

MANAGING WASTE HEAT WITH THE WATER COOLING TOWER,
Marley Co., Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-00232

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
For primary bibliographic entry see Field 05B.
W71-00236

HAMPTON V NORTH CAROLINA PULP CO (PRIVATE REMEDY FOR POLLUTION).
For primary bibliographic entry see Field 06E.
W71-00243

ALLOWABLE THERMAL POLLUTION LIMITS - A PHYSICOCHEMICAL APPROACH,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 05C.
W71-00250

SOME OBSERVATION OF STREAMFLOW AND WATER QUALITY IN THE URBAN ENVIRONMENT,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 04C.
W71-00318

FEEDING VALUE OF CATTLE MANURE FOR CATTLE,
Auburn Univ., Ala. Dept. of Animal Science.
For primary bibliographic entry see Field 05E.
W71-00329

THE FUTURE OF FARM ANIMAL WASTE MANAGEMENT,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
James A. Moore, and Donald B. Brooker.
Agricultural Engineering, Vol 51, No 7, p 414, 417, July 1970.

Descriptors: *Farm waste, *Water treatment, *Water pollution control, *Long term planning, Manure, Odor, Agricultural engineering.

Predicts the future development of livestock waste management schemes. It includes a discussion of future water quality requirements as well as the necessity for odor control. The need for mechanization as well as increased energy consumption are discussed. (Miner-Iowa State)
W71-00331

LIVESTOCK WASTE MANAGEMENT STUDIES-TERMINATION REPORT,
Illinois Univ., Urbana. Agricultural Experiment Station.
For primary bibliographic entry see Field 05D.
W71-00342

STEAM INJECTION, OIL RECOVERY TECHNIQUES, AND WATER QUALITY,
Orange County Water Pollution Control Dept., Santa Ana, Calif.; and Orange County Flood Control District, Santa Ana, Calif.
J. C. Roberts, and J. W. Williams.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1437-1445, August 1970. 9 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Oil fields, *Injection wells, *Secondary recovery (Oil), *Steam, *Water quality, Water pollution effects, Water pollution sources, Flooding, Injection, Oil reservoirs, Groundwater.
Identifiers: Well tests, Steam injection.

Steam is injected into oil wells to decrease oil viscosity and improve production rates and ultimate recovery. The effect of steam injection on oil zone waters is not well known. A survey of steaming practices in the Yorba Linda Field in California was made. Extensive tests were run on a number of parameters for a shallow-zone well, and it was concluded that the water being produced was representative of the groundwater in that zone. Except for silica concentration, steaming does not seem to affect water quality in the shallow zone of the Yorba Linda Field. (Knapp-USGS)
W71-00371

PHYSICAL DATA OF POTOMAC RIVER TIDAL SYSTEM INCLUDING MATHEMATICAL MODEL SEGMENTATION,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski, and Leo J. Clark.
Chesapeake Technical Support Laboratory Technical Report No 43, Federal Water Pollution Control Administration, 1970. 49 p, 9 fig, 15 tab.

Descriptors: *Estuaries, *Data collections, *Hydrologic data, *Water pollution sources, *Virginia, Maryland, District of Columbia, Tides, Channel morphology, Model studies, Streamflow, Mathematical models, Depth, Cross-sections, Profiles.
Identifiers: Potomac Estuary.

In water quality studies of the Potomac, the Chesapeake Technical Support Laboratory (CTSL) collected data on the physical characteristics of the estuary. Factors of major importance are: surface and cross-sectional areas, volumes, and distances between bridges, buoys, prominant landmarks and other reference points. This is not only essential for mathematical modeling studies but also to interpret field survey information. The tidal portion is several hundred feet in width at its head at Washington and broadens to nearly six miles at its mouth. A shipping channel with a minimum depth of 24 feet is maintained upstream to Washington. Except for this channel and a few short reaches where depths up to 100 feet can be found, the tidal portion is relatively shallow with an average depth of about 18 feet. The mean tidal range is about 2.9 feet in the upper portion near Washington and about 1.4 feet near the Chesapeake Bay. The lag time for the tidal phase between Washington and the Chesapeake Bay is about 6.5 hours. Effluents from twelve major waste water treatment plants, with a thirteenth under construction, serving a population of about 2,500,000, are discharged into the upper tidal system. The locations of the discharges from these treatment facilities are shown. (Knapp-USGS)
W71-00375

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 05D.
W71-00409

TREATMENT OF WASTE EATER - WASTE OIL MIXTURES.
Armco Steel Corp., Middletown, Ohio.
For primary bibliographic entry see Field 05D.
W71-00410

WATER AND SEWERAGE STUDY, SECOND PHASE.
Morris County Planning Board, Morristown, N.J.

Available from NTIS as PB-193 081, $3.00 in paper copy, $0.95 in microfiche. Elson T. Killam Assoc., Millburn, N.J. May 1970. 74 p.
Identifiers: *Urban planning, *New Jersey, *Water supplies, Urban planning, *Sanitary engineering, Urban planning, Water pollution, Control, Drainage, Water resources, Groundwater, *Sewers, *Regional planning and development, *Waste treatment, *Waste treatment facilities, *Watersheds, *Morris County (New Jersey).

At the present time practically all the Public Water Purveyors within the County derive their water supply from wells, with the greatest concentration of use being in the Central and Eastern portions of the County. Other water supply sources will be required, necessitating the development of surface supplies. The supplies and transmission facilities being developed by the Morris County Municipal Utilities Authority are discussed. Adequate sewerage facilities and treatment facilities needed in the future are discussed.
W71-00435

A MASTER SEWERAGE PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.

Elson T. Killam Assoc. Millburn, N.J., April 1970. 83 p.
Identifiers: *Roads, Sand, *Structures, Drainage, Interactions, Shear stresses, Pipes, Deflection, Compressive properties, Strain (Mechanics), Flexible structures, Mathematical models, Ohio, *Culverts, Soil stabilization.

The report presents a Master Sewage Plan for Union County, New Jersey. It includes the analysis of existing facilities, as presented in the First Stage Report, entitled, 'Sanitary Sewerage Facilities in Union County'. This report analyzes by comparing their capacity to present and projected sewage flows and the New Jersey State Department of Health Standards.
W71-00436

RICHMOND REGIONAL SEWERAGE PLAN AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.

Available from NTIS as PB-192 437, $3.00 in paper copy, $0.95 in microfiche. McGaughy, Marshall and McMillan, April 1970. 57 p.
Identifiers: *Urban areas, Sewage, *Sewage, *Management planning, Sanitary engineering, Disposal, Volume, Pipes, Fluid flow, Virginia, *Regional planning, Development, Richmond (Virginia), Sewage treatment.

The Sewage Plan is an areawide plan for long range development of sewage systems. The Plan provides for coordination and cooperation between political subdivisions and private firms involved in fulfilling the present and future sewer requirements for the area: The basic framework is included for: Waste water collection and treatment systems; The areas

to be served and the general capacities and requirements of the system. The plan provides for the development of a unified coordinated system capable of providing for future growth of the regional population while considering economic forecasts and land use plans. (See also W71-00446)
W71-00445

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.

Available from NTIS as PB-192 442, $3.00 in paper copy, $0.95 in microfiche. McGaughy, Marshall and McMillan, April 1970. 76 p.
Identifiers: *Urban areas, Water supplies, *Management planning, Data, Volume, Sources, Civil engineering, Virginia, *Regional planning, Development, Richmond (Virginia), Water consumption, Water services.

The volume consists of tabulated water demands by demanded zones and other supplementary technical data pertinent to the basic report. (See also W71-00445)
W71-00446

WATER AND SEWER FACILITIES PLAN: VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.

Available from NTIS as PB-190 865, $3.00 in paper copy, $0.95 in microfiche. Clark, Dietz and Associates, March 1970. 46 p.
Identifiers: *Water supplies, *Florida, *Sanitary engineering, Urban planning, Sewage, Wastes, Water pollution, Control, Management planning, Maps, Tables, *Volusia County (Florida), Water treatment, Regional planning.

The principal purpose of this study is to recognize the magnitude of the problems of supplying water and collecting, treating and disposing of human wastes from the urban areas of the county through the year 2000, and to develop a long-range concept and general plan demonstrating how these problems should be solved.
W71-00450

STORM DRAINAGE IN THE TOLEDO REGIONAL AREA.
Toledo Regional Area Plan for Action, Ohio.
For primary bibliographic entry see Field 04A.
W71-00454

WATER AND SEWER PLAN FOR THE TUSCALOOSA METROPLITAN AREA.
Tuscaloosa Area Council of Local Governments, Ala.

Available from NTIS as PB-191 340, $3.00 in paper copy, $0.95 in microfiche. Rust Engineering Co., Birmingham, May 1969. 56 p.
Identifiers: *Urban planning, *Alabama, *Water supplies, *Sanitary engineering, Urban areas, Population, Costs, Construction, Management planning, Area planning, Development, *Tuscaloosa (Alabama).

Contents: Population of Tuscaloosa County; Physical features and natural resources; Existing water and sewer facilities in Tuscaloosa County; Future water improvements; Future sewerage improvements; and Costs of water and sewer improvements.
W71-00459

FACTORS IN TECHNOLOGY TRANSFER: THE CASE OF CORNING PYREX ACID-WASTE DRAINLINE,
Syracuse Univ., N.Y.
E. B. Fredrikson, and E. W. Lawson.

Available fron NTIS as N70-21116, $3.00 in paper copy, $0.95 in microfiche. Occasional Paper No. 1, July 1969. 15 p.
Identifiers: *Borosilicate, Technology utilization, Budgeting, Industry, Manufacturing, Transfer functions.

A technology transfer analysis is presented, consisting of two major factors: (1) a combination of tedious development work, an imaginative individual, and luck; and (2) a well planned marketing program. The case of the chemical and heat resistant acid waste drainline is used as an example. The development process, choice of materials, subsequent product improvements, and marketing of the drainline are described.
W71-00460

WATER QUALITY CRITERIA FOR SELECTED RECREATION USES,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 06B.
W71-00471

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05D.
W71-00476

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
Wendle R. Snapp, and Robert A. Lemon.
Available from NTIS as PB-195 201, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $2.00, I 67.13/4: 11024 DMS 05/70. Water Pollution Control Research Series - 11024 DMS 05/70 May 1970. 250 p, 60 tab, 101 fig, 10 plates, 21 ref. FWQA Program 11024DMS, Contract No. 14-12-200.

Descriptors: *Sewers, *Infiltration, *Overflow, *Water pollution control, Surveys Computer programs, Storm runoff, Flow measurement, Sewers, Rainfall-runoff relationships, Sampling, Construction costs.
Identifiers: Sewer infiltration, Sanitary sewers.

Results are given of investigations, on 25 percent of Roanoke, Virginia's separate sanitary sewerage system, on the amounts of infiltration for various storm intensities and durations and the amounts of sewage overflow from the system, From these results the system was analyzed, using an in-house developed computer program, to assess the magnitudes and frequencies of overflows. The generated data from the analysis were used to develop an optimum design for remedial measures to reduce sewer overflows. Costs estimates are presented for the various items of work involved.
W71-00478

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.

Available from NTIS as PB-195 169, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 11024 DOK 02/70, Feb. 1970. 69 p, 10 tab, 20 fig, 38 ref. FWQA Project 11024 DOK, Contract No. 217-01-68.

Descriptors: *Electrodes, *Flow control, *Flow rates, Sewage, Outlets, Water pollution control, Overflow, Dissolved oxygen, Pollution abatement, Storm runoff.
Identifiers: *Combined sewers, *Electrode potential, *Sewage overflows, Sewer outfalls.

The effectiveness was investigated of electrode potential measurements to modulate discharges from comvined and storm sewer overflows to reduce stream and estuarine pollution. Studies included varying the composition of sewage, flow rate and examining the tendency to polarize or coat the electrodes under actual flow conditions. The analysis of experimental results shows a high degree of correlation between the electrode potential of the sewage and its strength. Linear correlation coefficients between electrode potential were determined for BOD, COD, Sulfides, total phosphorus, nitrates, and chlorides. It was demonstrated that the potential will be more negative the greater the S— concentration, except when a small amount of DO is present which exerts an attenuating influence. Flows carrying substantial concentrations of reducing substances with a detrimental impact on the dissolved oxygen reservoir of any receiving waters must be kept from exerting their damaging influence on bathing beaches, tidal estuaries and other water resources. Controlling the flow from outfalls by the electrode potential should significantly help to minimize such insults to the environment.
W71-00479

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker, and William E. Cox.
Available from NTIS as PB-195 170, $3.00 in paper copy, $0.95 in microfiche. Also published as Virginia Water Resources Research Center Bulletin 37, 'Legal Aspects of Water Supply and Water Quality Storage'. Water Pollution Control Research Series 16090 FPW 03/70, August 1970. 235 p, 6 append. FWQA Contract WP-01087. FWQA Program 16090 FPW.

Descriptors: *Water rights, *Federal-State water rights conflicts, Federal jurisdiction, Riparian land, State jurisdiction, Water Law, *Water storage, Water Quality, *Flow augmentation, Legal aspects, Water pollution control, Low-flow augmentation.

Enabling legislation for storage of water in Federal reservoirs for supply purposes and quality control through low-flow augmentation includes the Water Supply Act of 1958, the Watershed Protection and Flood Prevention Act, and the 1961 Amendment to the Federal Water Pollution Control Act. The Flood Control Act of 1944 and the Federal Water Power Act also have possible applicability. The enabling legislation and other law defining the operating procedure of the federal water resource agencies make water supply and water quality storage somewhat dependent on the provisions of state water law. State law may affect the aquisition of water rights for storage and the procedure whereby it is applied to its intended functions. The impact of state law on the aquisition process varies according to whether water rights are aquired by the United States or by a private party. When private interests are responsible, as in the case of water supply storage in Corps of Engineers and Soil Conservation Service facilities, the aquisition of rights is not as complex as when a Soverign is involved. Aquisition of water rights by the federal government gives rise to federal-state jurisdictional problems and several unresolved questions concerning water rights. State law also affects the use of a natural channel as a conduit because it defines the rights of others to use this water after it is released from storage. A liberal policy of permitting others to use the stored water would have the potential effect of diminishing the benefits to the water supply or water quality storer. (Johnson-Virginia Polytechnic Institute)
W71-00480

JOHN B KELLY, INC V LEHIGH NAV COAL CO (POLLUTION OF RIVER BY COAL MINING INDUSTRY).
For primary bibliographic entry see Field 06E.
W71-00505

TICHENOR V HARBISON (DISCHARGE OF OIL WELL OVERFLOW INTO NATURAL WATERCOURSES).
For primary bibliographic entry see Field 06E.
W71-00514

WATKINS V PEPPERTON COTTON MILLS (PRESCRIPTIVE RIGHT TO DUMP SEWAGE).
For primary bibliographic entry see Field 06E.
W71-00528

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
For primary bibliographic entry see Field 06E.
W71-00530

CHAPMAN V AMERICAN CREOSOTING CO (LIABILITY FOR POLLUTION OF WELLS AND SPRINGS).
For primary bibliographic entry see Field 06E.
W71-00538

LATONIA REFINING CORP V DUSING (OIL REFINERY LIABLE FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-00540

HUNZE V CITY OF CAPE GIRARDEAU (LIABILITY FOR STREAM POLLUTION BY MUNICIPALITY).
For primary bibliographic entry see Field 06E.
W71-00542

SHELLEY V OZARK PIPELINE CORP (CHARACTERIZATION OF OIL PIPELINE LEAK AS TEMPORARY OR PERMANENT NUISANCE).
For primary bibliographic entry see Field 06E.
W71-00543

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 04A.
W71-00025

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).

Proceedings of the Tucson Symposium, International Association of Scientific Hydrology and Unesco, Vol I and II, 1969. 755 p.

Descriptors: *Analog computers, *Digital computers, *Hydrology, *Mathematical models, *Groundwater, *Surface waters, *Application methods.
Identifiers: Hybrid computers.

In order to bring together the analog and digital specialists and the practising hydrologists and to give each an opportunity to become acquainted with the other's views and problems, the Coordinating Council for the International Hydrological Decade organized a Symposium at Tucson, Arizona in cooperation with the International Association of Scientific Hydrology, Unesco, the American Geophysical Union, the United States National Committee for the International Hydrological Decade and the University of Arizona. This joint publication by the International Association of Scientific Hydrology and Unesco of the papers presented at the Symposium considered the following aspects: (1) Analogue Computing Techniques; (2) Digital Computing Techniques; (3) Digital Data Handling Techniques; (4) Hybrid Computing Techniques; (5) Comparative Studies of Computing Techniques; and (6) Mathematics of Computing Techniques. Some papers (Groups 5 and 6) discussed the general theoretical and philosophical aspects of modelling and computers, but most of them described applications (three first groups). The papers of the first series were mostly in relation with problems on groundwater but some of them considered more specific problems such as the influence of man. In the second group, papers were mostly in relation with problems on surface waters: floods, runoff, precipitation, water quality, etc. The different fields of hydrology were represented in the third group. (See also W71-00072 through W71-00095) (Kriss-Cornell)
W71-00071

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02A.
W71-00072

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California Dept. of Water Resources; and TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 04B.
W71-00073

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
Gary S. Risch.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 268-279, 1968. 10 p, 2 fig, 5 tab.

Descriptors: *Optimization, *Dynamic programming, *Linear programming, *Economics, Reservoirs, Cost, Hydrology, California.
Identifiers: Eel River Project, California.

Development of the Eel River, involving three potential reservoirs and a connecting tunnel, provided an opportunity for the use of linear and dynamic programming on a medium sized project. A computer model was formulated for both linear and dynamic programming solutions. The techniques aided the planner in analyzing hydrologic and economic problems and provided an optimum economic solution with less effort than expended using conventional methods. Because of increased computer time inherent in linear programming, dynamic programming was chosen for the part two sizing problem and linear programming was therefore used for the part one sizing problem. The object function was to minimize the system cost, given a required system yield. Dynamic programming maximized overall efficiency. For the Eel River problem, three reservoirs comprised three stages and the various values of firm water yield for each stage was considered by the states. Using a trial and error optimization method, every possible sequence of interrelated decisions was explored, (See also W71-00071) (Kriss-Cornell)
W71-00077

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
For primary bibliographic entry see Field 04A.
W71-00080

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 04A.
W71-00088

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00150

OPTIMIZATION OF CONJUNCTIVE USE OF WATER IN A STREAM-AQUIFER SYSTEM, USING LINEAR PROGRAMMING,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00182

MULTIRESERVOIR OPERATION STUDIES,
Arizona Univ., Tuscon; and Network Analysis Corp., Port Washington, N.Y.
Theodore G. Roefs, and Lawrence D. Bodin.
Water Resources Research Vol 6, No 2, p 410-420, April 1970.

Descriptors: *Reservoir operation, *Stochastic processes, *Streamflow, Optimization, Mathematical studies, Computers, Computer program, Risks, Decision-making, Storage, Hydroelectric power, Model studies, Probability, Inflow, Discharge, Dynamic programming, Flood control, Costs.
Identifiers: Multireservoir studies, Dantzig-Wolfe.

The determination of a reservoir operation rule has been treated as a 'worst case' deterministic problem. This has been severely criticized but at present there is a dearth of valid alternative methods. An implicit stochastic process is compared to possible alternative analytical processes. This process refers to a sequence of steps consisting of streamflow synthesis, deterministic optimization, and multivariate analysis of deterministic optimization results. Some formulations based on the method of Dantzig-Wolfe decomposition are shown to be reasonably accurate presentations of a nonlinear multireservoir deterministic optimization problem. The authors analyze the procedures for the determination of an optimal operation problem in terms of the economic factors involved. They conclude that, although it would produce large cost savings in the operation of large multiple reservoir systems, the answer will necessitate technological development at substantial expense, this expense will make the operation economically unfeasible. (Murphy-Rutgers)
W71-00281

ECONOMETRICS AS PIONEERING IN NONEXPERIMENTAL MODEL BUILDING,
Uppsala Univ. (Sweden). Inst. of Statistics.
Herman O. Wold.
Econometrica Vol 37, No 3, p 369-381, July 1969.

Descriptors: *Economic research, *Operations research, *Mathematical studies, *Forecasting, Model studies, Economic evaluation, Prices, Demand, Regression analysis, Income, Social aspects, Planning, Research.
Identifiers: *Econometrics, *Operation analysis, Experimental models, Nonexperimental models, Unirelational models, Multirelational models.

Econometrics serves the purposes of operations analysis, thus involving a synthesis of experimental and nonexperimental model building. This paper

focuses on three aspects of econometric model building and operations analysis. The first is the gradual evolution in the construction of unirelational models and the succeeding rise in aspiration levels by building multirelational models. The second aspect is that of econometrics as a spearhead in the nonexperimental methods of model building. The third aspect deals with the lessons that can be drawn from econometrics to promote interdisciplinary developments of the social sciences. The widespread use of econometric methods in water resources research makes its evaluation in terms of the scientific evolution of interest to the water researcher. (Murphy-Rutgers)
W71-00288

A NOTE ON REGIONAL INPUT-OUTPUT MODELS,
South Carolina Univ., Columbia.
Teddy T. Su.
The Southern Economic Journal Vol XXXVI, No 3, p 325-327, January 1970.

Descriptors: *Input-output analysis, *Regional analysis, *Imports, Model studies, Economic evaluation, Labor, Capital, Industrial production, Technology, Demand, Income, Employment, Government, Investment, Taxes.
Identifiers: *National input-output, Input-coefficient matrix, Income multiplier, Employment multiplier.

Many water resource development projects are concerned with the overall economic development of the area in which they are located. This paper attempts to supplement traditional regional input-output models with a practical analytical tool based on the modified national input-output model. The author emphasizes the importance of imports from other regions and uses the national input coefficients only to reflect the technology of the normal production process. The article argues that values of income and employment multipliers in other regional input-output models based on national input coefficients are overestimated. Thus, any regional economic projections will appear to be too optimistic without accounting for the effects of imports into the region. These conclusions should lead to some changes in the method in which the water researcher attempts to determine the effect of, and future need for, water resource development. (Murphy-Rutgers)
W71-00295

THE SYMMETRIC FORMULATION OF THE SIMPLEX METHOD FOR QUADRATIC PROGRAMMING,
Calgary Univ. (Alberta); and Purdue Univ., Lafayette, Ind.
C. Van De Panne, and Andrew Whinston.
Econometrica Vol 37, No 3, p 507-527, July 1969.

Descriptors: *Mathematical studies, *Economic evaluation, *Programming, *Optimization, Model studies, Distribution patterns.
Identifiers: *Simplex method, *Quadratic programming, *Tableaux, Convergence, Symmetry, Symmetric variant, Parametric methods.

This article gives a reformulation of the simplex method for quadratic programming with the advantage of generating tableaux of certain symmetry properties. The quadratic programming problem is briefly stated, and the equations of the Kuhn-Tucker conditions are formulated. These equations are used to give the set-up tableau from which all other tableaux are derived. The symmetric variant of the simplex method for quadratic programming is then explained and, using the symmetric properties of the tableaux, explicit formulas for triangular tableaux are developed. The properties of the standard tableaux are derived and the relationships with other methods are studied. The potential use of quadratic programming in water resources research makes this article relevant to researchers interested in obtaining a basic understanding of the technique. (Murphy-Rutgers)
W71-00298

INVESTIGATING CAUSAL RELATIONSHIPS BY ECONOMETRIC MODELS AND CROSS-SPECTRAL METHODS,
Nottingham Univ. (England).
C. W. J. Granger.
Econometrica Vol 37, No 3, p 424-438, July 1969.

Descriptors: *Economic evaluation, *Model studies, *Mathematical studies, Statistics, Regression analysis, Correlation analysis, Fluctuation.
Identifiers: *Econometrics, *Feedback, Causality, Spectral methods, Causal lag.

The object of this paper is to discuss the relationships between certain classes of econometric models involving feedback and the functions arising in spectral analysis, particularly the cross-spectrum and the partial cross-spectrum. The paper demonstrates that in the two-variable case the feedback mechanism can be broken down into two causal relations and that the cross-spectrum can be considered as the sum of two cross-spectra, each closely connected with one of the causations. Measures of causal lag and causal strength can then be constructed. A generalization of this result with the partial cross-spectrum is then suggested. The potential use of spectral analysis in empirical analyses of water resources makes this article relevant to the water area. (Murphy-Rutgers)
W71-00299

COMMENT ON FACTOR ANALYSIS AND REGRESSION,
Chicago Univ., Ill.
Benjamin King.
Econometrica Vol 37, No 3, p 538-540, July 1969.

Descriptors: *Mathematical studies, *Statistical analysis, *Regression analysis, Model studies, Economic evaluation, Measurement, Least squares method, Random processes.
Identifiers: *Econometrics, *Multicolliniarity, *Factor analysis, Factor loading matrix.

This paper attempts to demonstrate that if one believes in an underlying factor analysis model involving fewer factors than there are variables, this is equivalent to the acceptance of an error in the variables model for which the parameters may be calculated directly from the factor loading matrix. However, difficulties arise if interest is in the coefficient interpreted as the marginal contribution of this variable to the dependent variable. The problem then becomes one of having more than one solution. The author also objects to the assumption of perfect multicollinearity among the true variables, as implied by the factor model. Cases of errors in the variables and high intercorrelation are frequent in econometric studies in water resources. Accordingly, this paper may provide useful methodology for empirical studies in the water area. (Murphy-Rutgers)
W71-00302

URBAN (MUNICIPAL) WATER MANAGEMENT,
Syracuse Univ., N.Y. Coll. of Forestry.
For primary bibliographic entry see Field 06B.
W71-00317

FLOOD PLAIN MODELING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-00321

DYNAMIC PROGRAMMING FOR OPTIMUM CONJUNCTIVE USE,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W71-00323

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
Thomas R. Burke.
Water Resources Bulletin, Vol 6, No 4, p 661-681, July-Aug 1970. 2 fig, 7 tab.

Descriptors: *Municipal water, *Water demand, *Planning, *Model studies, Social aspects, Data collections, Regression analysis.
Identifiers: *Economic model, *Water resources planning, Initial effort.

With the increasing Federal role in all aspects of water resource planning, the need for a planning model to enable calculations of projected Municipal Water requirements has become evident. This study represents an initial effort at developing an economic model of Municipal Water requirements which (1) incorporates variables (or proxies) reflecting the various factors affecting water demand (i.e., demographic, social, industrial), and (2) requires only readily available, published data for its use. This model permits determinations of the water requirements of 488 cities grouped into 19 geographic regions or 'Pseudo States.' Separate regression functions have been fitted to the cities within each of the 19 regions. Derivation of the exact functions for each region entailed a cross section stepwise regression analysis in which some 8 different variables were examined. (Marriott-Chicago)
W71-00324

ELECTRONIC ANALOG MODELING AS AN AID IN WATER RESOURCE INVESTIGATIONS,
Soil Conservation Service, Hyattsville, Md. Central Technical Unit.
E. B. Warnick.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 621-623, September-October 1969. 3 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Water resources, *Water resources development, *Investigations, *Analog models, Electronic equipment, Systems analysis, Streamflow, Surface waters, Groundwater, Irrigation, Precipitation (Atmospheric), Runoff, Crops, Wetlands, Turbidity, Reservoirs, Water management (Applied), Planning, Conjunctive use, Cost-benefit analysis.
Identifiers: Historical data, Sevier River Basin (Utah).

The complex interrelation of surface water, groundwater and return flow from irrigation diversions of the Sevier River Basin, Utah has fostered the use of an electronic analog model in processing data to aid in the water supply and distribution analysis. By using the analog model described, the Sevier River Basin Study staff has been able to analyze in more detail a greater variety of potential water management improvement projects. Because of this variety, it was possible to develop generalized relations to describe the possible future impacts on river flow and groundwater reservoirs caused by potential projects. Local sponsors of improvement proposals using the relations developed can plan a series of coordinated projects where the adverse downstream effects of a project in one area can be overcome by another project in the downstream area. This type of coordinated planning can maximize the economic benefits and minimize costly mistakes in managing the water resources available within the basin. Graphs, maps, tables of data and pictures of the analog model are included. (Woodard-USGS)
W71-00404

MATHEMATICAL MODEL OF SIMPLEST HYDROECOLOGICAL SYSTEM,
V. V. Menshutkin, and A. A. Umnov.
Trans. from Gidrobiol. Zhurn. No. 2, 1970. Available from NTIS as JPRS 50770, $3.00 in paper copy, $0.95 in microfiche. Joint Publications Research Service Trans 50770. June 18, 1970. 11 p.
Identifiers: *Ecology, Mathematical models, Marine biology, Aquatic animals, Population, Models (Simulations), Microorganisms, Plankton, Oxygen, Carbon dioxide, Algae, Organic compounds, Inorganic compounds, Energy conversion, Chemical reactions, USSR, *Food chains.

An abstract model of a hydroecological system including not only energy transformation and dissipation but also the turnover of organic and inorganic matter is presented. Inclusion of the cycle of biogenic elements in the model is an expansion of Vinberg's and Anisimov's ideas.
W71-00440

6B. Evaluation Process

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 06F.
W71-00002

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.

Florida Department of Natural Resources Report, 1970. 205 p, 72 fig, 53 tab, 337 ref.

Descriptors: *Water resources, *Water resources development, *Florida, Groundwater, Surface waters, Water sources, Water supply, Recreation, Irrigation water, Municipal water, Industrial water, Data collections, Hydrologic data, Hydrogeology, Aquifers.
Identifiers: St. Johns River basin (Florida).

A report on studies of water availability and use in the state of Florida covers approximately 11,431 square miles and includes all or parts of 19 counties in the St. Johns River basin. Sub-basins draining into the St. Johns River and the adjacent coastal sub-basin were included. Projections for the time frames 1980, 2000 and 2020 were used throughout. A broad hydrological inventory shows water occurrence and availability by source. Chemical and biological quality considerations are included. Major uses of the water resources are discussed by major user type and geographic area. Use projections are given by type and water source. Programs underway and planned by Federal, State, regional and local agencies are listed. Potentials for development are discussed as alternative solutions. The recreation situation in the basin is given with primary emphasis on water-related recreation. The recommendations are problem-oriented and are an extension of the potentials for development, land, and recreation sections. (Knapp-USGS)
W71-00010

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.

Report on Development of Water Resources in Appalachia published in 25 volumes. Corps of Engineers, Office of Appalachian Studies Summary Report, Vol 1 of 25 Vol, Part 1, Main Report, December 1969. 241 p, 17 fig, 16 tab, 10 ref.

Descriptors: *Water resources development, *Water requirements, *Surveys, *Planning, *Appalachian Mountain region, Area redevelopment, Natural resources, River basin development, Water resources, Hydrologic data, Data collections, Investigations.
Identifiers: *Appalachian redevelopment.

The investigations required to carry out a special survey of water and related resources in the Appalachian Region have been completed, and the plan developed is summarized. The purposes of the water resources survey embrace two of the most important fields of national policy: economic development and growth, and natural resource conservation and development. These purposes are: to analyze the water resource potential in Appalachia in relation to the need for accelerated economic development in this region; to develop a long range plan under which the water resources of Appalachia may be effectively utilized to further the economic and social goals of the region. This plan will require coordination among Federal, State and local development efforts; to identify water and related resources investments which may be undertaken immediately or in the near future for the development of Appalachia; and to provide a framework of continuing cooperative relationships for further planning of water resources for Appalachian economic development. (See also W71-00052) (Knapp-USGS)
W71-00051

SOCIO-ECONOMIC PROBLEMS IN WATER RESOURCE USE AND CONTROL - PRODUCTION FUNCTIONS AND SOCIAL COSTS,
Auburn Univ., Ala. Water Resources Research Inst.
Donald R. Street.
Available from NTIS as PB-194 786, $3.00 in paper copy, $0.95 in microfiche. Auburn University School of Business Report Series 1, May 1970. 24 p, 11 fig, 8 ref. OWRR Project B-012-ALA (2).

Descriptors: *Water resources development, *Water management (Applied), *Economics, *Resource allocation, Multiple purpose, Systems analysis, Water conservation, Optimization, Benefits, Costs, Decision making, Operations research, Social aspects.
Identifiers: Resource management, Production functions.

Some production effects which are possible in water resource use and control, with implications on the economic welfare of the community are discussed. Recent research in Alabama and in other areas has shown that trends in the growth of industrial and municipal use of water indicate an increased incidence of conflicts which may affect future income alternatives. Problems appear in the form of various external effects, social costs, and interactional effects which originate according to the method or ordering of water resource use. Some opportunities and techniques for resource adjustment in solving water-related problems are discussed. The production function is fundamental to all economic development in an area. Basically, the production function is a relationship between inputs of resources, such as land, labor, and capital, and some product used by society. Systems analysis methods may also be adapted to solving resource allocation problems. (Knapp-USGS)
W71-00166

SELECTED BIBLIOGRAPHY-LOWER MEKONG BASIN.
United Nations Engineer Agency for Resource Inventories, New York.
For primary bibliographic entry see Field 10.
W71-00229

COMPETITIVE RECREATIONAL USES OF SELECTED IOWA LAKES,
Iowa State Water Resources Research Inst., Ames.
Arnold O. Haugen, and Arnold J. Sohn.
Available from NTIS as PB-194 800, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Iowa State Water Resources Research Institute, June 30, 1968. 173 p, 45 tab, 38 fig, 21 ref, 2 append. OWRR Project A-005-IA (1).

Descriptors: *Recreation, Recreation facilities, *Boating, *Lakes, Swimming, Recreation demand, Boat-launching ramps, *Water utilization, Iowa, Sport fishing, Waterfowl, Hunting.
Identifiers: *Recreational use patterns, Clear Lake, Spirit Lake, Okoboji Lake, Little Wall Lake, Eagle Lake, Ventura Marsh.

A study to determine cycles and fluctuations in recreational activity was conducted during 1966 and 1967 on Clear, Spirit, Okoboji, and Little Wall Lakes. Major emphasis was placed on summer activities, with checks of waterfowl hunting intensities on Eagle Lake and Ventura Marsh conducted during the fall hunting seasons. In addition to describing activity cycles, an attempt was made to analyze areas of present or future conflict between users. Primary sources of data included: Time-lapse movie camera records as indices to activity cycles; questionnaires to short-term visitors and permanent residents on the lakes; pneumatic car-counter records at park entrances and boat-launching ramps; line intercept counts of boat traffic; counts and location plottings of boats on the lakes; and interviews with lake personnel including Water Safety Patrol officials, resort operators, and other businessmen located near the lakes. It is recommended that: (1) a limit of 50 be placed on the number of power boats permitted on Little Wall Lake at one time, or on the size of motors allowed on the lake; (2) steps should be taken immediately to isolate swimming facilities from boat launching facilities, a minimum distance of 300 feet should be allowed between ramps and swimming areas; (3) lake front property should be acquired at a resonable price in the future. Portions of Clear and West Okoboji lakes should be zones to a 'No Wake' speed for power boats, thereby providing areas for fishing, canoeing, etc.; (4) marshes such as Eagle Lake should be managed for waterfowl production and hunting areas. Drainage, dredging, or flooding, other than to improve waterfowl conditions, is not recommended, (5) opening of newly constructed reservoirs in Iowa will require studies to analyze changes and other trends in recreational use patterns.
W71-00230

ENGINEERING AND ECONOMIC RELATIONS IN THE SELECTION AND CLASSIFICATION OF IRRIGABLE LANDS,
Bureau of Reclamation, Denver, Colo.
John T. Maletic, and Waldron H. Yarger.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.297-26.310, Mexico City, 1969. 16 p, 4 fig, 19 ref.

Descriptors: *Land classification, Land development, Land reclamation, Land settlement, Land resources, Land use, Engineering, Economics, Land, *Irrigable land, Project planning, Social aspects, Farms, Irrigation, Farm units, Drainage, Economic feasibility, Bibliographies.
Identifiers: Engineering economy, *Selection, Irrigated agriculture.

Successful settlement of irrigation projects can best be handled by integration prior to construction of the project facilities of several disciplines into a forecast of desirable and practical measures for development of each farm unit. An irrigation suitability classification provides the basic information on land resources of the project area. Unlike soil surveys, many initial agronomic, economic, and engineering aspects of project planning are incorporated in this classification. Subsequent integration with drainage costs, water service costs, and economic limitations permits the selection of lands to be served and a forecast of requirements for farm unit development, such as landforming, drainage, farm water application facilities, soil amendments, farming equipment, and credit and capital requirements. The project plan should include a forecast and timing of who will provide the amount of capital and labor inputs for putting the land into production most expeditiously. In the developing nations, irrigation project planners should make a special effort to develop plans reflecting the social and cultural environment which, to a large extent, determines the success of the project. (USBR)
W71-00262

A REVIEW OF INTER-REGIONAL AND INTERNATIONAL WATER TRANSFER PROPOSALS.

West States Water Council, Salt Lake City, Utah, June 1969. 13 p, 3 map, 30 ref.

Descriptors: *Water resources, Water resources development, *Planning, Natural resources, *Inter-

basin transfers, Surplus water, Reviews, Water supply, Foreign countries, Mexico, Bibliographies.
Identifiers: Western States Water Council, Canada, *Interbasin water transfer, International relations, *Water plans.

Large-scale water transfers reviewed are international in scope and involve Canadian sources. Unitl Canada has fully evaluated future needs and resources of the prairie provinces, very little serious discussion of any proposal to export water from central Canada is expected. Fourteen interregional and interbasin water transfer plans in the U S are discussed. Inventories of water and land resources, and the development of statewide and basinwide water plans are needed. Any meaningful large-scale water transfer proposal should be the result of careful basin-by-basin evaluation of natural supplies, thoughtful projections of future needs, and cooperative consideration of long-range development. (USBR)
W71-00265

THE RELATIONSHIP AMONG THE FEDERAL GOVERNMENT DISTRICT BOARDS, MANAGERS AND WATER USERS ON NEW IRRIGATION AND DRAINAGE PROJECTS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03F.
W71-00268

THE MEASUREMENT OF BENEFITS OF TROUT FISHING: PRELIMINARY RESULTS OF A STUDY AT GRAFHAM WATER, GREAT OUSE WATER AUTHORITY, HUNTINGDONSHIRE,
Birmingham Univ. (England). Dept. of Industrial Economics and Business Studies.
Robert J. Smith, and N. J. Kavanagh.
Journal of Leisure Research Vol 1, No 4, p 316-332, Autumn 1969.

Descriptors: *Recreation, *Fishing, *Demand, Benefits, Costs, Economic evaluation, Statistics, Planning, Prices, Reservoir, Time.
Identifiers: *Grafham Water, *Demand curve, *Willingness to pay, Visitation rates.

This paper is concerned with the empirical estimation of a demand curve for a trout fishery. The reasons for measuring the economic benefits of recreation and the difficulties involved in obtaining an objective measure of these benefits are discussed. The authors explain the economist's approach to recreation valuations and outline several benefit measures. A measure of benefits requires information on prices. The methodology developed by M. Clawson to provide this type of information is described. The basis of this approach is a relationship between distance and visitation rates from zones surrounding the fishery. Using this methodology the authors attempt a study of the data on trout fishing at Grafham Water. They measure the recreational demand for trout fishing at this site, as well as estimate the monetary benefits of trout fishing under various assumptions with respect to the valuation of angler's time. (Murphy-Rutgers)
W71-00275

ECONOMIC ASPECTS OF THE ENVIRONMENT,
Resources For the Future, Inc., Washington, D.C.
Allen V. Kneese.
In: Regional Planning Challenge and Prospects New York, Frederick A. Praeger, 1969, p 88-91.

Descriptors: *Decision making, *Water pollution, *Natural resource allocation, *Economies of scale, *Regional analysis, *Planning, Technology, Taxes, Government, Watercourse, Costs, Reservoirs, Waste treatment.
Identifiers: Externalities, Market place, Spillover costs, Urban economics.

This article discusses the approach of economics to problems of environmental quality. It is proposed that normative economic theory's basic premise that individual choice should govern resource use to its maximum extent, is useful in such environmental problems. Three major questions are discussed in order to increase the efficiency of the decision-making process in determining the allocation of resources. The first is whether a satisfactory allocation of income exists which would facilitate a collective ethical standard in environmental quality. The second is whether decisions on the use of resources are really independent of each other- i.e. are the costs of using a watercourse for waste disposal borne only by those deciding to use the watercourse for that purpose. The third and final question asks whether collective decision making can realize economies of scale inherent in the economy's technology. The questions have arisen from the problems of pollution in regional planning and should aid the economist in a decision-making position in the water resources area. (Murphy-Rutgers)
W71-00276

TIME BIAS IN RECREATION BENEFIT ESTIMATES,
Battelle Memorial Institute, Columbus, Ohio.
Frank J. Cdsario, and Jack L. Knetsch.
Water Resources Research, Vol 6, No 3, p 700-704, June 1970.

Descriptors: *Economic value, *Recreational demand, Constraint, Water resource development, Monetary costs, Economic welfare.
Identifiers: *Recreational benefit, *Time cost, *Trade-off function, *Bias, Travel costs, Proxy, Indivisibilities, Convexity.

The authors are concerned with the measurement of outdoor recreation benefits associated with activities involving water resource use. A benefit measure is defined operationally in terms of what an individual would be willing to pay to use the resources rather than have to go without the resource services. The willingness to pay criterion is measured by the area under the aggregate demand curve. Previous attempts at estimating the benefits of outdoor recreation have involved the estimation of recreation demand curves with travel cost data as a proxy for prices. This method related changes in cost of visits to changes in number of visits per capita. There has been a conservation bias in the benefit estimate obtained because of the omission of travel time differences. This article suggests the use of a trade-off function between money and time costs in order to eliminate bias. The author expects larger recreation benefits through the use of this technique. This refinement in the measurement of outdoor recreation should be an aid to overall water resource planning. (Siegenthaler-Rutgers)
W71-00277

WEIGHING RISK IN CAPACITY EXPANSION,
Lilly (Eli) and Co., Indianapolis, Ind.
John R. Virts, and Richard W. Garrett.
Harvard Business Review, Vol 48, No 3, p 132-141, May-June 1970. 6 fig, 1 tab, 1 append.

Descriptors: *Risks, - Distribution patterns, Forecasting, Computer models, Statistical methods.
Identifiers: *Capacity, Production facilities, Affordable risk ratio, Capacity expansion.

A company's manufacturing capacity must be designed to support its marketing plans while also satisfying corporate strategy and objectives. But because the uncertainties of product and process forecasts tend to be cumulative, the task of estimating future requirements for facilities, which depends on these prior forecasts, is a difficult one. A first step in developing a facilities plan is to balance the risks and uncertainties of forecasts with the economic penalties of having too much or too little capacity. However, figures for sales and yields are normally uncertain, and forecasts are continually being revised. As such, facilities planning becomes complex. The authors develop a method of measuring the risk in facilities planning making use of computerized model of plants serving worldwide markets. The model uses operations research and microeconomic theory to produce an affordable risk ratio. This has been used by Eli Lilly and Company to compare alternative plans for expansion of facilities. This may prove to be of interest to the water researcher concerned with decisions pertaining to the creation of new facilities. (Loeb-Rutgers)
W71-00283

DO MANAGERS FIND DECISION THEORY USEFUL,
Michigan Univ., Ann Arbor.
Rex V. Brown.
Harvard Business Review, Vol 48, No 3, p 78-89, May-June 1970. 1 fig.

Descriptors: *Decision making, Probability, Return costs, Benefits, Risks, Management.
Identifiers: *Decision theory analysis, *Decision theory, *Manager, Quantitative analysis, Obstacles.

The author presents in this paper a discussion pertaining to decision theory. In particular, the author considers a set of techniques of quantitative analysis which is referred to in the paper as Decision Theory Analysis (DTA). The primary purpose of this article, which is based on a survey of 20 companies, is to present some of the experiences of practitioners who have been exploring various applications of DTA techniques to management decision making. These experiences should help would-be users to identify particular situations in their own companies where the new technology might greatly benefit them, and to build on the lessons learned by earlier users. The aritcle discusses such questions as: the tangible impact DTA has on how businesses are run and how individual decisions are made, the areas of decision making DTA is best suited for, what practical benefits result, what trends in usage are apparent, what obstacles lie in the way of more effective usage, how management can make the use of DTA more effective and what remains to be done in developing and expanding the usefulness of DTA. This may prove valuable to the water researcher or water manager involved with decision making. (Loeb-Rutgers)
W71-00284

PUT POLICY FIRST IN D C F ANALYSIS,
Olivetti Co., Ivrea (Italy).
Paul Welter.
Harvard Business Review Vol 48, No 1, p 141-148, January-February 1970.

Descriptors: *Investment, *Economic evaluation, *Discount rate, *Costs, *Capital, Interest rate, Financing, Computers, Rate of return, Risk, Decision-making, Profit, Taxes, Management.
Identifiers: *Discounted cash flow, Growth, Debt/equity ratio, Bonds, Logic flow chart.

The problems of evaluating alternative investments in the water resource area are numberous and have led, in many instances, to the use of discounted cash benefit flow (DCF) as the most appropriate tool for investment appraisal. The author discusses the two major processes involved in DCF analysis; calculating DCF, and determining the appropriate discount rate. The calculation of DCF involves a decision as to the proper method, either rate of return net present value or discounted pay-back period. Once this is done it is necessary to estimate the cash flow and to evaluate the risks involved. The author next discusses the determination of the discount rate. This is especially troublesome in the water resource area due to the presence of externalities. The proper rate is evaluated in terms of the minimum acceptable rate of return and the need for future investment capital. With the inclusion of social benefits into the discount rate this method is directly applicable to water resource investments. (Murphy-Rutgers)

W71-00285

MANAGEMENT EVOLUTION IN THE QUANTITATIVE WORLD,
Virginia Univ., Charlottesville.
Robert F. Vandell.
Harvard Business Review Vol 48, No 1, p 83-92, Jan-Feb 1970.

Descriptors: *Management, *Statistical methods, *Data processing, Economic efficiency, Computers, Technology, Costs, Benefits, Financing, Labor, Programs, Planning, Risk, Decision-making.
Identifiers: *Quantitative analysis, Decentralization, Manpower, Hardware, Marketing, Mobility.

The recently acquired tools of quantitative analysis and data processing have made possible more complete evaluations of investment alternatives in the water resource area. However, this article shows that management must undergo some radical changes if these tools are to be utilized fully. The author discusses the shape these changes will take and sets forth some guidelines managers can use in preparing themselves for the changes. The evolution of more economically efficient methods of management over the next decade will suffer sharp discontinuities unless a concerted effort is made to understand these two tools. The relevance of the author's observations to water utility management makes this article of interest to the water researcher. (Murphy-Rutgers)
W71-00286

RISK AND THE SOCIAL RATE OF DISCOUNT,
Northwestern Univ., Evanston, Ill.
Mark V. Pauly.
American Economic Review Vol LX, No 1, p 195-198, March 1970.

Descriptors: *Rate of discount, *Investment, *Government, Risk, Income, Cost benefit analysis, Economic evaluation, Rate of interest, Economic efficiency, Taxes.
Identifiers: *Social rate of discount, Public investment, Bonds, Rate of return.

The article attempts to clear up the controversy about the proper rate of discount to use in evaluating benefit and cost streams from public investment. Since a proper discount rate is an important part of the economic evaluation of water resource projects, this article should be of use to the water researcher. The author shows that the rate at which individuals are willing to loan money to the government necessarily understates the true social cost of the investment and should not be used as the social rate of discount. It is also shown that if taxation-induced distortions are ignored, the correct rate for evaluating government investment opportunities may be equal to, or greater than, the private rate of return. (Murphy-Rutgers)
W71-00287

APPROACHES TO VALUE CHOICES,
Wayne State Univ., Detroit, Mich.
Norman Wengert.
In: Regional Planning-Challenge and Prospects, New York, Frederick A. Praeger, 1969, p 98-102.

Descriptors: *Environmental effects, *Cost-benefit analysis, *Planning, Decision-making, Streams, Technology, Natural resource allocation, Economic analysis, Engineering personnel, Sanitation.
Identifiers: *Environmental change, Democracy, Majority rule, Economists, Professional interest, Sanitarians.

This article discusses the problems of values in environmental planning. The author points out that environmental decisions will be effected by the often conflicting goals of different professionals with different objectives. Such individuals as economists, engineers, sanitarians, and fishermen would have widely diverse suggestions about what would be environmentally best for a stream. Such differences are based on technological background, authority, and associates of each person involved. To deal with such difficulties, the author suggests three basic needs. The values must be identified, an awareness of mechanisms and processes for making value choices must be developed, and it must be recognized that value decisions often involve hard choices. The author stresses the importance, in decision-making for environmental planning, of a cost benefit analysis of the factors involved. Finally, it is emphasized that, to be rational, environmental planning must be constantly directed toward a specific goal, thus necessitating long-range as well as short-range planning. (Murphy-Rutgers)
W71-00289

AGENCY BUDGET PROBLEMS,
Bureau of the Budget, Washington, D.C.
Carl W. Teller.
In: Public Budgeting and Finance, Itasca, Illinois, Peacock Publishers, 1968, p 332-338.

Descriptors: *Budgets, *Government, Decision-making, Planning, Evaluation, Priorities, Efficiency, Financing, Forecasting, Environment, Costs, Economic impact, Economic justification.
Identifiers: *Governmental agencies, *Budget cycle, Budget presentation.

Budgeting serves as a means of weighing choices and determining priorities. Thus this clarification of some of the problems involved should aid the decision-maker in the water resource area. The basic budget considerations which must be considered are outlined and the five most important facets of a budget officer's responsibility discussed. The author then studies problems of budgeting in government agencies which he considers as problems of environment, problems inherent in the budget process or problems relating to budget presentation. These difficulties are analyzed and suggestions made to alleviate them. Throughout the article the author stresses the need to make the budgeting process a more effective tool for decision-making. (Murphy-Rutgers)
W71-00290

IDENTIFICATION AND SPECIFICATION ANALYSIS OF ALTERNATIVE EQUATIONS FOR ESTIMATING THE ELASTICITY OF SUBSTITUTION,
Tulane Univ., New Orleans, La.
J. R. Moroney.
The Southern Economic Journal Vol XXVI, No 3, p 287-299, January 1970.

Descriptors: *Profits, *Returns to scale, Economic evaluation, Capital, Labor, Model studies, Maximization, Statistics, Economic efficiency, Demand, Industrial production, Optimization, Prices, Costs.
Identifiers: *Elasticity of substitution, *Production function, Cost minimization.

This paper seeks to examine the nature of the assumptions of many previous authors, in estimating the elasticity of substitution between capital and labor, regarding constant returns to scale and purely competitive product and factor markets. The author suggests that the usual estimates of the coefficients of the production function are biased because of certain specification errors. The article proposes an alternative estimation that is not restricted by the above assumptions. The author argues that this alternative equation is free from specification errors and is suitable for estimation under conditions of non-constant returns to scale and imperfectly competitive product markets. Attempts at estimating production functions for the water utility industry have been hampered by the use of the profit-maximizing relation with which the author finds fault. The reliance on the cost minimization relationship that the article suggests, should more accurately describe the elasticity of substitution in the water resources area. (Murphy-Rutgers)
W71-00291

ALTERNATIVE RATE OF RETURN CONCEPTS AND THEIR IMPLICATIONS FOR UTILITY REGULATION,
Stanford Univ., Calif.
Ezra Solomon.
The Bell Journal of Economics and Management Science Vol 1, No 1, Spring 1970, p 65-81.

Descriptors: *Capital, *Costs, *Discount rage, *Economic evaluation, *Utilities, *Government, Depreciation, Growth rates, Prices, Investment, Taxes, Model studies, Budgets, Forecasting, Planning.
Identifiers: *Rate of return, *Utility regulation, Book rate unit, Expensing policy, Discounted cash flow.

The rate of return on invested capital is widely used as a basis for decisions in utility regulation. One of its essential purposes is to provide a comparison between actual or prospective performance and the cost of capital, which is the required or expected performance. Large utilities often set prices to achieve the rate of return dictated by the regulatory agencies. However, there is a problem in that the rate of return is measured in terms of two distinct units. The book rate unit is defined as the ratio of income during a given period of time to the net book-value of invested capital outstanding. The discounted cash flow unit measures the return on capital in terms of the annual rate at which the future new funds flows from an investment have a discounted value equal to the value of investment outlays required to bring about these fund flows. This paper indicates the relationship between the two measures and shows the impact of some variations in depreciation and expensing procedures, growth rate, etc. The paper should be of use in the regulation of water utilities. (Murphy-Rutgers)
W71-00292

TAXATION, SUBSTITUTION AND INDUSTRIAL LOCATION,
Rice Univ., Houston, Tex.
Charles B. McLure.
Journal of Political Economy, Vol 78, No 1, p 112-132, Jan-Feb 1970.

Descriptors: *Taxes, *Government, *Economic evaluation, *Model studies, Consumption, Prices, Government supports, Capital, Income, Mathematical studies, Labor wages, Demand, Industry.
Identifiers: *Industrial location, *Factor mobility, *Substitution, Unemployment, Elasticity.

This paper is an attempt to develop a theory on the impact of tax policy on the location of industry. It is relevant to the water resource planner interested in the effect on the regional economy of resource development projects. A general equilibrium neoclassical model is used to outline several important determinants of the sensitivity of industrial location to various general taxes levied in a state. This model may be extended to measure the effects of water resource projects on the local economy. The model employs comparative statics analysis to emphasize the role played by substitution in consumption and production and by the mobility of factors in determining the direction and strength of industry's locational response to taxation. The examination is limited to the analysis of the capital flows induced by interstate differentials in various kinds of general taxes in a full employment economy. (Murphy-Rutgers)
W71-00293

THE ECONOMICS OF CONGESTION AND POLLUTION: AN INTEGRATED VIEW,
Massachusetts Inst. of Tech., Cambridge.
Jerome Rothenberg.
American Economic Review Vol LX, No 2, p 114-121, May 1970.

Descriptors: *Environmental pollution, *Economic evaluation, *Mathematical models, Prices, Income, Planning, Profit, Demand, Cost, Government, Population, Sewerage, Benefits, Economic efficiency, Optimization, Resource allocation, Investment.

Identifiers: *Public goods, *User charges, *Urban congestion, *Generic congestion.

Environmental pollution and urban congestion have much in common and an exploitation of this similarity throws light on why the problems are so critical, what their consequences are and what kinds of measures can be used to mitigate their damage. This paper integrates the distinctive characteristics of the two together, as aspects of one phenomenon. The author first discusses the nature of the socioeconomic interaction. The ramifications are then explained through the use of a mathematical model treating both the positive and normative considerations. Under the broad classification of the generic congestion process, some specialized forms of congestion and pollution are considered. The author demonstrates that a system without congestion charges will differ from one with charges primarily by more congestion at any one time and a more rapid worsening of the problem over time. As a part of environmental pollution, water pollution abatement could benefit from the application of the conclusions reached here. (Murphy-Rutgers)
W71-00294

ACTIVITY SPECIALIZATION AMONG OHIO'S RECREATION BOATERS,
Texas A and M Univ., College Station; and Ohio State Univ., Columbus.
Carlton S. Van Doren, and Barry Lentnek.
Journal of Leisure Research Vol 1, No 4, p 296-315, Autumn 1969.

Descriptors: *Recreation, *Boating, *Demand, *Economic evaluation, Statistics, Water demand, Social aspects, Time, Lakes, Regression analysis, Computer program, Fishing.
Identifiers: *Automatic Interaction Detector, *Multivariate techniques, Social status, Boating equipment, Recreational time, Activity analysis, Sailing, Water skiing.

In order to plan outdoor recreational facilities to meet future requirements of a large urbanized population, demand for specific outdoor activities must be estimated. For this it is necessary to know the social and economic characteristics of persons engaging in specific activities. This article attempts to identify the characteristics that differentiate boat activity specialists. The authors review the literature dealing with this problem and then summarize the methodological problems of predicting demand factors for outdoor recreation. They use the Automatic Interaction Detector program, which is a multivariate technique, as a predictive tool for characterizing activity preferences. Twenty-one variates were used to describe the demographic characteristics of the boating parties, the amount of time spent boating and the kind of equipment used. The authors conclude that the normal social variates are not predictive of activity specialization. This article is relevant to water studies attempting to forecast the recreational use of a water project. (Murphy-Rutgers)
W71-00297

COORDINATION IN ENVIRONMENTAL PLANNING,
New York State Dept. of Health, Albany.
Meredith H. Thompson, and M. M. Hufschmidt.
In: Regional Planning-Challenge and Prospects, New York, Frederick A. Praeger, 1969, p 103-105.

Descriptors: *Planning, *Water pollution, *Economic evaluation, *Regional analysis, Water resources, Land use, Waste treatment, Air pollution, Navigation, Urban renewal, River basin, Environmental effects, Government, Training, Sewerage.
Identifiers: *In service training, *Environmental planning, Housing.

The authors reiterate the need for coordinated environmental planning and suggest that water resource planners, land use planners, zoners, realty planners, solid waste planners, and air pollution planners must all be brought together to achieve comprehensive environmental planning. Coordination is the key to this, since it is logically impossible to include in a single organization all of the persons responsible for transportation, water resources, or urban renewal development in one region. Such comprehensiveness does not demand unification under one particular bureau, but rather coordinated activity of several pertinent agencies. For instance, comprehensive water pollution control includes groundwater pollution, which in turn involves housing, zoning, and land use. However, the author does point out that a single agency must be responsible for working with comprehensive short and long range plans to integrate agency findings into a final workable product. (Murphy-Rutgers)
W71-00301

A METHODOLOGY FOR THE CONSTRUCTION OF ATTITUDE MEASURING INSTRUMENTS,
Missouri Univ., Rolla.
R. N. Sawyer, and T. E. Harbaughn.
Water Resources Bulletin, Vol 6, No 3, May-June 1970, p 401-407. 3 fig, 15 ref.

Descriptors: *Attitudes, *Methodology, Instrumentation, Decision-making, Water resources, Planning.
Identifiers: *Attitude scale, Opinions, Likert scale, Thurstone scale.

To the average layman, the distinction between opinion and attitude is artificial at best, and is neither consistant nor logically defensible. For many purposes one need not distinguish between the two. However, when assessing opinion and attitude the disparity becomes quite evident. Opinion surveys are characteristically concerned with replies to specific questions which need not be related. The responses are kept separately as opposed to being combined into a total score. Attitude scales, on the other hand, typically yield a total score indicating both a direction and intensity of an individual's feelings, thoughts, and predispositions to act toward a given concept. Further, in the construction of an attitude scale, the different statements are designed to measure a single attitude or unidimensional variable. The Likert method of constructing attitude measuring instruments requires a large number of judges to indicate their own attitudes by responding to statements thought to pertain to an attitude in question. Five possible responses are provided for each item. The procedure to construct a Thurstone type scale utilizes The Law Categorical Judgement as a basis. Statements are obtained and analyzed for the various categories and in final form, the attitude scale is presented to the respondent who indicates statements with which he agrees or disagrees. (Marriott-Chicago)
W71-00309

PUBLIC INVESTMENT AND PLANNING: A RESPONSE,
National Audubon Society, New York.
Roland C. Clement.
Water Spectrum, Vol 2, No 2, p 1-4, Summer 1970. 7 ref.

Descriptors: *Planning, *Investment, Institutional constraints, Institutions, Federal government, Coordination, Administration, Social values, Management, Multiple purpose projects.
Identifiers: *Public investment, *Bureaucracy, Multiple-objective programs, U.S. Army Corps of Engineers.

This article is a response to an earlier article on public investment and planning by Arthur Maass. It is felt that the earlier piece did not integrate the various points which were well made and that in several cases, the analysis was insufficient. Several areas of difference are indicated. First, the Corps of Engineers is not really prepared to execute multi-objective programs due to 'bureaucratic schizophrenia,' i.e., an old line civilian bureaucracy oriented toward maintaining project authorizations and the more flexible and advanced military policy-makers. Second, a more rational role in water resources by the Corps is impossible without a reassessment of national needs. Finally, the question of whether the Corps can develop a realistic water resource program is not only a question of capability but also of willingness. (Davis-Chicago)
W71-00310

NEW CONCEPTS IN WATER RESOURCES PLANNING,
Corps of Engineers, Chicago, Ill. North Central Div.
James S. King.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968), ed. Phillip Cohen, Martha N. Francisco, p 703-710.

Descriptors: *Planning, *River basin development, *Multiple-purpose projects, *Federal government, State governments, *Local governments, *Institutional constraints, Water Resources Planning Act, Economic efficiency, Interagency cooperation.
Identifiers: *Multiple objectives, *Corps of Engineers, *Criteria, *Mississippi River Basin Study, *Legal constraints, Non-government interests, Green Book, Kerr report, Senate Document No. 97, Water Resource Policy Commission, Missouri Basin Survey Commission, Advisory Committee on Water Resources Policy, Public Law 89-4, Interdisciplinary approach.

Comprehensive water and related land resources planning is a technique of decision making pertaining to the allocation of scarce resources among competing claims. Its ultimate objective is to provide a sound basis on which public investment decisions can be made. An historical picture is given beginning with Federal and State concerns regarding navigation and later irrigation. Hydroelectric power and improved quantity and quality of water supplies followed. Theodore Roosevelt's recognition of conservation initiated a philosophy of integrated multipurpose river basin planning. During the 30's the Corps of Engineers surveyed the major river basins and Federal-State-local drainage commissions were established for all of them. Developments after World War II are reviewed including principles of economic analysis in the 'Green Book', three Presidential Commissions during the 50's, the Kerr report, Senate Document No. 97, the Water Resources Planning Act, and Public Law 89-4. The author suggests that a multiple-objective approach is needed and mentions three broad areas of responsibility and action: Establishment of broad, first-line objectives at the national level; central planning to translate first-line objectives into criteria for formulating plans; formulating an optimum water resources plan, or alternative plans, by field level planning groups. Two types of comprehensive basin studies are suggested: those appraising the institutional and legal constraints thus providing a 'framework' and those utilizing these 'frameworks' within a detailed sub-basin. Observations of the Type 1 Upper Mississippi River Comprehensive Basin Study are included. Three alternative first-line objectives are outlined and it is suggested that one plan is able to satisfy them to varying degrees. (Preckwinkle-Chicago)
W71-00316

URBAN (MUNICIPAL) WATER MANAGEMENT,
Syracuse Univ., N.Y. Coll. of Forestry.
Robert D. Hennigan.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968) ed. Phillip Cohen, Martha N. Francisco, p 716-723.

Descriptors: *Administration, *Urbanization, *Water supply, *Drainage, *Waste water disposal, *Water quality, *Economic efficiency, *Utilities Federal government, State government, Local government.

Identifiers: City of New York, Suffolk County, Buffalo-Erie County, Nassau County, Monroe County.

The author argues that the major water resources problem in the country today is poor urban water management. Urban water management consists of water supply development and distribution, surface drainage collection and disposal, and waste water collection treatment, and disposal. With increasing urbanization local water regimen changes drastically resulting in loss of base flow, and in greatly increased storm flows. Rapid runoff also adds to the pollution load. Controversies related to urban water management are mentioned including allocation of Delaware waters involving Delaware and New York, the Colorado River controversy involving Los Angeles, the Chicago Diversion Case, and pollution of the Great Lakes and various other waters. The other traces development of water management from rural society where individual responsibility existed through further developments that dealt with problems as they arose. Resulting from this was a separation of water supply service from other services. Following World War II multiple governmental units were becoming more evident in large urban communities and consolidation efforts rare. Both technically and organizationally, water management needs cannot be dealt with separately. The bases for both the optional governmental service concept and for essential utility services concept are listed in two sets of propositions. Conclusions are that all three services should be consolidated in all urban areas, and given an independent revenue base and status. Financing should be based on user charges. (Preckwinkle-Chicago)
W71-00317

LAND AND WATER RESOURCES MANAGEMENT FOR ENVIRONMENTAL IMPROVEMENT,
Department of Agriculture, Washington, D.C.
Lloyd E. Partain.
Water Resources Bulletin, Vol 6, No 2, April 1970, p 229-234.

Descriptors: *Land management, *Water management, Conservation, Education, Attitudes, Research and development, Decision making.
Identifiers: *Environmental management, *Public awareness, Educational programs.

Traditional conservation measures may not be, and usually are not, all that is needed to assure a quality environment. They are, however, fundamental. A national course of action involving land and water management is determined (1) at the market place, (2) at the ballot box, and (3) in the hearts and minds of individuals. To inform people about environmental management and conservation and appropriate uses of land, water and related resources is an exceedingly difficult problem. Research, action and educational programs dealing with environmental problems must have greater attention and support. (Marriott-Chicago)
W71-00320

EFFECTIVE WATER RESOURCES MANAGEMENT IN THE URBAN SETTING,
Colorado Univ., Boulder. Dept. of Civil Engineering.
J. Earnest Flack, and Duane W. Hill.
Water Resources Bulletin, Vol 6, No 4, p 563-572, July-Aug 1970. 3 fig, 18 ref.

Descriptors: *Water management, *Cities, Flood plain management, Attitudes, Administration, Social aspects, Psychological aspects, Systems analysis, Planning, Behavior.

Water resources management in the urban areas of the United States to be effective must include dimensions far beyond water supply and sewage. This paper concerns itself with those problem areas of water resource management outside of potable water supply and sanitary sewers. These areas include flood plain management, greenways and blueways, storm water, vistas of waterways, and other attributes of living in or near a water-related environment. The perceptions and attitudes of the concerned public and community power structure must be known in order to manage the water environment effectively. Methods of measuring these perceptions and attitudes are described and ways in which the resulting citizen-resource can be tapped and use as a management device are explored. (Marriott-Chicago)
W71-00322

WATER OF THE WORLD AND ITS FUTURE,
Akademiya Nauk SSSR, (Moscow).
M. I. Lvovitch.
Water Resources Journal, United Nations-Economic Commission for Asia and the Far East (ST/ECAFE/SER. C/83), p 1-26, December 1969. 26 p, 8 tab, 21 ref.

Descriptors: *Water resources development, *Water reuse, *Water demand, *International waters, Water law, Water supply, Water management (Applied), Water utilization, Planning.
Identifiers: World water use.

The threat of water resources depletion exists and in some regions it has already become a reality. The main reason for this state of affairs is that the policies on which the use and conservation of water resources have been, and are supposed to be based in the future, have, as a rule, become outdated. They were applicable in the past when water needs were small in relation to the available water resources. In many regions which were previously considered rich in water resources, a water deficit has become or is becoming apparent. These regions are found in almost all of Europe, considerable parts of Asia and Africa, and the southern part of North America. A water crisis is not inevitable. The depletion of water resources can be avoided: mankind need not be threatened by a water crisis if more rational policies are adopted in the use and conservation of water resources. An end must be made to the use of rivers, lakes, reservoirs and seas as media for the purification of sewage waters. A start must be made to reducing the water consumed in production in every possible way; decreasing the water consumption per unit of production; searching for ways and means to change over to 'dry' production; and eliminating unproductive losses through evaporation from water and soil surfaces. It may be possible to transform and regulate the hydrologic cycle. More attention should be devoted to the problem of locating population and industry in accordance with the distribution of water resources. It is essential to observe a multipurpose approach in solving water economy problems. (Knapp-USGS)
W71-00398

HAZARDS TO PEOPLE AND ANIMALS FROM BUREAU-CONSTRUCTED CANALS, OPEN AND CLOSED CONDUIT SYSTEMS PROGRAM,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08A.
W71-00437

TEXAS MARINE RESOURCES: THE LEISURE VIEW,
Texas A and M Univ., College Station.
Clare A. Gunn.
Available from NTIS as PB-192 956, $3.00 in paper copy, $0.95 in microfiche. June 1970. 21 p. TAMU-SG-70-110.
Identifiers: *Natural resources, Seacoast, *Economics, Texas, Mexico Gulf, Symposia, Geography, Recreation, Problem solving, Management planning, Climatology, Commerce, Fishes, Transportation, Culture, Sea Grant program, Tourism, Marine resources.

This booklet represents a summary statement of the third Texas A and M University Sea Grant Workshop. 'Marine Resources: Leisure Uses.' The meeting was one in a continuing series of working sessions designed to find out the views of various user groups concerned with marine resource development in Texas. The statement is one of consensus. It reflects the concern of each participant for a well-managed coastal zone for the state. (Author)
W71-00438

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00446

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM SALLISAW, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00456

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, DESHA COUNTY, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00457

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, VAN BUREN, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00458

WATER QUALITY CRITERIA FOR SELECTED RECREATION USES,
Illinois Univ., Urbana. Water Resources Center.
Doyle D. Bishop, and Robert Aukerman.
Available from NTIS as PB-195 164, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center, Research Report 33, September 1970. 134 p, 18 tab, 22 ref, append. OWRR Project B-034-ILL (1).

Descriptors: Recreation, *Water quality, *Attitudes, *Behavior, Water pollution effects, *Standards, *Planning, *Recreation demand.
Identifiers: Perceptions, User satisfaction, Criteria, Quality of experience.

Four types of outdoor recreationists were investigated to determine whether they differed in their attitudes, beliefs, and behavior regarding various water characteristics at Central Illinois water-based recreation sites. Using an attitude model derived from social-psychological research, the recreationists' attitudes toward the sites were estimated from their attitudes and beliefs about water characteristics. The site attitudes were regarded as indicators of the quality of the respondents' recreation experience resulting from characteristics of the water. The major analyses were comparisons of the recreationist groups' perceptions of the water, attitudes toward water characteristics, the site attitudes held because of water characteristics, reports of decreased site use because of water characteristics, and reports of probable termination of site use because of water characteristics. The relationships between site attitude components resulting from selected water characteristics and the reports of decreased site use and probable termination of use were also investigated. The results indicated that the four types of recreationists differed in their perceptions of the water, attitudes toward water characteristics, site attitudes, and the reported water characteristics that had caused or might cause decreased site use. In addition to these

group differences, there were strong individual differences within the various groups. Site attitudes were not highly related to reported behavior.
W71-00471

INLAND PORT FACILITIES AND ECONOMIC GROWTH,
Mississippi State Univ., State College. Bureau of Business and Economic Research.
A. A. Armenakis, H. J. Moore, and G. T. Peden.
Available from NTIS as PB-195 166, $3.00 in paper copy, $0.95 in microfiche. Completion Report, October 1970. 78 p, 16 tab, 7 ref, append. OWRR Project A-032-MISS (1).

Descriptors: *Ports, *Economics, *Water transportation, *Input-output analysis, Mississippi, Economic prediction, Income, Costs.
Identifiers: Earnings (Monetary), *Economic growth.

Overall economic growth for each of three Mississippi inland port counties was compared to the aggregate of all non-port counties for the period 1959-1968. The measures selected were total personal income, total earnings, farm earnings, nonfarm earnings and manufacturing earnings. The role of each Mississippi inland port in economic growth was analyzed first by comparing the growth rates for Mississippi inland ports to other inland ports on the Mississippi River System during the period 1959-1968; and second, by studying the changes in commodity groups handled by each Mississippi inland port during the study period. On intra-port analysis of each Mississippi inland port provided the basis for concluding that the existence of each port made on important contribution to economic growth. An analysis of the relative contribution of each port in 1968 to its repective regional economy was performed by constructing partial input-output tables for each port county.
W71-00473

PRELIMINARY WASTE WATER REPORT FOR THE OUTER AREA.
Northeastern Illinois Planning Commission, Chicago.
For primary bibliographic entry see Field 05D.
W71-00485

PRELIMINARY WASTE WATER PLAN FOR THE INNER AREA; SUPPLEMENT NO. 1, RECOMMENDED PLAN FOR DUPAGE COUNTY.
Northeastern Illinois Planning Commission, Chicago.
For primary bibliographic entry see Field 05D.
W71-00486

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
For primary bibliographic entry see Field 06A.
W71-00077

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 04A.
W71-00088

SOCIO-ECONOMIC PROBLEMS IN WATER RESOURCE USE AND CONTROL - PRODUCTION FUNCTIONS AND SOCIAL COSTS,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-00166

REPAYMENT INTEREST RATES FOR WATER PROJECTS,
Utah State Univ., Logan.
Daniel H. Hoggan.
Water Resource Research Vol 6, No 3, p 683-689, June 1970.

Descriptors: *Reimbursable costs, *Cost sharing, Financial feasibility, Cost allocation, Economic evaluation, Benefits, Discount rate, Risks.
Identifiers: *Repayment interest rate, Subsidy, Coupon rate, Opportunity costs.

Federal government policy with respect to the repayment interest rate has not been uniform. This interest rate is used to repay reimbursable costs of water projects and is related to the financial feasibility of a project. Usually the government has based its repayment interest rates on coupon rates of long term government bonds. The lack of a consistent government policy on repayment interest rates has resulted in subsidies to lower paying interest uses, namely municipal and industrial water users. The author also criticizes the inequality between interest rates used in benefit-cost analysis and those of repayment on the assumption that money should be paid back at the same rate as it is advanced. He suggests in order to develop uniformity, the government must examine repayment interest rates in conjunction with cost sharing and reimbursement. (Siegenthaler-Rutgers)
W71-00280

INCENTIVE PRICING AND UTILITY REGULATION,
Michigan Univ., Ann Arbor.
John G. Cross.
Quarterly Journal of Economics, Vol LXXXIV, No 2, p 236-253, May 1970. 4 fig.

Descriptors: *Pricing, *Prices, Utilities, Economics, Resource allocation, Average costs, Profit, Costs.
Identifiers: *Incentive pricing, *Utility regulation, Economic inefficiency, Public control, X-efficiency, Regulatory lag.

The author contends that in recent years economists have been growing increasingly concerned that their analyses of monopolistic behavior have overlooked a major source of economic inefficiency. In the past, emphasis has been placed almost entirely on the allocation of resources. It is now becoming apparent that an equal weight ought to be placed upon the mechanism of production itself, for it is quite possible that in our economy, inefficiency through the sheer wasting of resources is at least as important as that due to the improper allocation and distribution of goods and services. The author contends that the elimination of lax management, outdated production methods, and sloppy cost-control procedures would make a substantial difference in the value of a firm's operations. This possibility raises a serious problem in the area of utility regulation since it suggests that an important form of inefficiency has not been subjected to public control. The author discusses a device whereby one might deal with this problem--incentive pricing. This article has relevance to improving the management of water utilities. (Loeb-Rutgers)
W71-00282

RISK ALLOWANCE IN ORIGINAL CAPITAL INVESTMENTS,
Virginia Polytechnic Inst., Blacksburg.
D. L. Michelsen, Jr., and J. R. Snead.
The Engineering Economist Vol 15, No 3, p 137-157, Spring 1970.

Descriptors: *Risks, *Uncertainty, *Economic evaluation, Taxes, Capital, Costs, Investment, Value, Profits, Optimization, Discount rate, Time, Decision-making, Income.
Identifiers: *Discounted cash flow, *Depreciation, *Reuse value, Present worth, Operational cash flow.

The object of this paper is to consider the risks involved in an original capital investment, and how an economic evaluation might be adjusted for these varying capital risks. Particular attention is given to the effect of taxes and the adjustment of original capital risk as a function of potential reuse should the investment fail. A number of illustrations are given in order to indicate the original capital investment for risk. To give a better measure of risk capital the authors propose: (1) that the present worth of the guaranteed depreciation cash flow be discounted at the cost of capital and subtracted from the total initial investment, and (2) reducing the original risk capital by the amount of reuse value. The risks inherent in many water resource investments may be more effectively integrated into the economic evaluation through the use of these suggestions. (Murphy-Rutgers)
W71-00296

WATER AND SEWER FINANCIAL PLAN.
Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga.

Available from NTIS as PB-190 220, $3.00 in paper copy, $0.95 in microfiche. November 1969. 51 p.
Identifiers: *Urban planning, *Georgia, *Water supplies, Economics, *Economics, Sanitary engineering, Water pollution, Control, Sewage, Purification, Law, Construction, Population, Costs, Feasibility studies, Maps, *Chatham County (Ga), Sewage treatment, Taxes.

The Plan is a guide for financing needed improvements. The Plan recommends that Chatham County take over the responsibility for providing water and sewerage to the more densely developed portions of the County. The sewage treatment facilities to be financed by General Obligation Bonds backed by a countywide ad valorem tax, the sewage collection systems and water systems to be financed by Revenue Bonds backed by user charges. The Plan also presents an alternate method of financing, where communities wish to retain their own water and sewage collection systems. With this method, Chatham County would provide sewage treatment facilities financed by General Obligation Bonds backed by a countywide ad valorem tax, and Sewer Service Districts or municipalities to finance sewage collection systems through the use of property taxes or user charges, and that water system improvements be financed by currently operating water agencies.
W71-00422

6D. Water Demand

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 06B.
W71-00051

GEOBOTANIC APPROACH FOR IMPROVEMENT OF RANGE RESOURCES IN DESERT AND SEMI-DESERT AREAS OF KAZAKHSTAN, USSR,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 03B.
W71-00146

STUDY OF WATER RESOURCES IN THE CHAD BASIN.
United Nations Educational, Scientific and Cultural Organization, Paris (France).

Nature and Resources, Vol 6, No 2, p 6-11, June 1970. 1 fig.

Descriptors: *Reservoir storage, *Water table, *Groundwater, *Watersheds (Basins), *Water resources, *Model studies, Mapping, Tracers, Water balance, Water levels, Water analysis, Planning, Hydrologic data, Hydrologic budget, Aquifers, Evaporation, Semiarid climates, Analog models.
Identifiers: *Africa, *Lake Chad, Chad basin.

The Chad basin is a closed hydrological system containing Lake Chad and a vast reservoir of groundwater. Four countries (Cameroon, Niger, Nigeria and Chad) with high population growth rates lie on the shores of the lake. A study conducted by the United Nations was designed to inventory water resources and discover hydrological mechanisms and relationships so that an integrated water policy might be planned by the nations involved. Tracer studies revealed no clear relationships between Lake Chad and the surrounding aquifers. A cartographic survey was made and maps were constructed on scales ranging from 1:50,000 to 1:5,000,000. Finally, an electric analog model was constructed to calculate the effects of drawoff on groundwater levels. The results were: (1) There is an almost uninterrupted water-table over 1,400,000 square kilometers, but with certain topographic anomalies; (2) An artesian aquifer may be present all around the lake, overlaying a second and deeper aquifer, but there is practically no recharge, thus calling for prudent use; (3) Surface water is much more plentiful than ground water; (4) Overall water balance figures show that evaporation totals over two-thirds of the output. (Casey-Arizona)
W71-00161

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
Micha Gisser.
Available from NTIS as PB-194 785, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, July 1970. 13 p, 1 fig, 1 tab. OWRR Project No. 3109-33-A-022 N Mex (1).

Descriptors: *Water demand, *Systems analysis, *Economic prediction, *Planning, *Semiarid climates, Irrigation, Crops, Water allocation (Policy), Water costs, Water utilization, Water values, Semiarid climates, Model studies, Estimating equations, Linear programming, Constraints, Irrigation water, Agriculture.
Identifiers: *Pecos River Basin, Water importation.

A linear programming model of agricultural demand for imported water was developed for the Pecos Basin. The model utilizes agricultural activities and obtains agricultural demand functions for differing imported water prices and for local water use constraints. A constraint (L) indicates the highest per acre quantity of irrigation water farmers are allowed to use. The types of constraint incorporated into the model were salinity, legal, vegetables (greater than 20 percent production leads to oversupply), acreage and cotton (allotments). The basic assumptions of the model were: (1) Agricultural production can be divided into separate independent activities, (2) Each activity is governed by constant return to scale and fixed proportions, (3) Activities are divisible. The demand results are shown for L—3 at various local and imported water prices. (Casey-Arizona)
W71-00165

WATER SUPPLY AND WATER POLLUTION CONTROL-APPENDIX D TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio. Ohio Basin Region.
For primary bibliographic entry see Field 05G.
W71-00225

COOLING TOWERS - A TECHNOLOGICAL TOOL TO INCREASE PLANT SITE POTENTIALS,
Marley Co., Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-00237

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
Cecil H. Allen.
In: Water Resources Bulletin, Vol 6, No 2, p 189-192.

Descriptors: *Management, *Water distribution (Applied), *Water demand, *Water supply, Water sources, Industrial water, Municipal water, Groundwater, Surface runoff, Water quality, Engineering, Economics.
Identifiers: *Houston, Texas.

Houston, the Nation's sixth largest city, is taking appropriate steps to assure an adequate water supply to meet its municipal and industrial demands through the year 2000. A three-phase study entitled 'A Comprehensive Study of Houston's Municipal Water System' will be used as a master plan for both the domestic supply and the distribution system. Houston's situation is unusual because it now relies on groundwater sources for 80 percent of its domestic water supply, but must convert this system to depend on surface water for 60 percent of its total supply source. Problems concerning the conversion are complex. Surface water is more costly. Reservoirs that meet the plans and standards of state and federal water authorities as well as conveyance and treatment facilities must be developed. The total groundwater withdrawal rate must be increased but at the same time shifted from one area to another because of subsidence problems. Solutions to these problems require careful engineering study as well as economic and sociological planning. The plan calls for operation of three water treatment plants linked to the distribution system by means of low-pressure arterial mains which in turn will supply booster pump stations located throughout the city. The low pressure groundwater supply will be linked to the low pressure surface water supply allowing for controlled dependence on each water source according to seasonal conditions. (Marriott-Chicago)
W71-00315

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-00324

ESTIMATED WATER USE IN FLORIDA, 1965,
Geological Survey, Washington, D.C.
R. W. Pride.
Florida Bureau of Geology Map Series 36, Department of Natural Resources, 1970. 1 sheet, 1 fig, 1 map, 1 tab, 5 ref.

Descriptors: *Water utilization, *Public utilities, *Irrigated land, *Nuclear powerplants, Industrial water, Florida, Hydrologic data, Water types, Saline water, Non-consumptive use.
Identifiers: *Hydrologic atlas, *Water use inventory.

Major uses and types of water are shown by color bars on a map scaled 1 inch equals 30 mi. The map report portrays where the largest quantities of fresh water for each major category of use are withdrawn. Estimates are given of the quantity of saline water circulated through thermoelectric power generating plants for cooling, 75% of which is from surface sources. Trends in water use, based on five-year estimates since 1950, are shown graphically, and a table gives total water use by type of use and source. Irrigation showed the most significant increase of the types of water use for the 1960-65 period. During 1965, 510,000 acre-ft of surface water and 650,000 acre-ft of groundwater were used on 490,000 acres of citrus crops; 260,000 acres of truck crops required 540,000 acre-ft of surface and 250,000 acre-ft of groundwater; and 500,000 acres of sugar cane, pasture and other crops were irrigated with 1,170,000 and 420,000 acre-ft, respectively, of surface and groundwaters. (Lang-USGS)
W71-00376

WATER OF THE WORLD AND ITS FUTURE,
Akademiya Nauk SSSR, (Moscow).
For primary bibliographic entry see Field 06B.
W71-00398

ADIRONDACK POWER AND LIGHT CORP V CITY OF LITTLE FALLS (RIPARIAN RIGHT TO UNALTERED RIVER'S FLOW).

148 Misc 191, 265 NYS 567-596 (1930).

Descriptors: *New York, *Riparian rights, *Natural flow doctrine, *Alteration of flow, Riparian land, Riparian waters, Competing uses, Diversion, Electric power, Municipal water, Obstruction to flow, Reasonable use, Relative rights, Judicial decisions, Rivers, River flow, Flow, Regulation, River regulation, Dams, Reservoirs, Water consumption, Consumptive use, Water utilization, Cities.

Plaintiff utility, a riparian landowner, brought an action against defendant municipality for damages caused by diversion of a river's waters from plaintiff's power plants. Plaintiff also sought an injunction to restrain such diversion. Plaintiff contended that as a riparian owner, it had the right to the river's flow past its premises in its natural course without diminution or obstruction thereto. Defendant contended that it had been granted the right to divert the waters of the river for consumptive municipal purposes by plaintiff's predecessor in title. The court construed the grant-in-title and held that defendant's right was subject to the restriction that it maintain the normal and natural flow of water by the use of regulatory reservoirs. Defendant had failed to construct and use such reservoirs, and consequently the conditions of the grant had not been met. Therefore, defendant was liable in damages to plaintiff for diverting the river's waters. Furthermore, such diversion constituted a continuing trespass upon plaintiff's water rights for which an injunction would lie. (Snow-Florida)
W71-00521

6E. Water Law and Institutions

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 06F.
W71-00002

REPORT OF THE UNITED STATES DELEGATION TO THE SIXTH SESSION OF THE COORDINATING COUNCIL OF THE INTERNATIONAL HYDROLOGICAL DECADE, UNESCO, GENEVA, SWITZERLAND, JULY 6-11, 1970.

International Hydrological Decade-UNESCO Report of 6th Session Coordinating Council, Geneva, July 6-11, 1970. 22 p, 2 append.

Descriptors: *International Hydrological Decade, *Conferences, Programs, Project planning, Hydrology, Research and development, Projects, Scheduling, United Nations.
Identifiers: UNESCO.

The report of the U. S. Delegation to the 6th session of the Coordinating Council of the International Hydrological Decade, UNESCO, is presented. Most of the Sixth Session of the Council was devoted to discussions of the working groups which are to be operative during the final half of the International Hydrological Decade. The US

Delegation went to the Sixth Session hoping to influence the Council to (1) reduce the number of working groups, and (2) simplify their terms of reference to include only priority items which can be achieved during the last half of the Decade. The Delegation was not successful in achieving either one of these objectives to a significant degree. (Knapp-USGS)
W71-00048

BRESHERS V NINETEENTH LA LEVEE DIST (DAMAGES RECOVERABLE FOR INJURY CAUSED BY LEVEE CONSTRUCTION).

165 So 494 (La Ct App 1936).

Descriptors: *Louisiana, *Eminent domain, *Compensation, *Levees, Judicial decisions, Legal aspects, Drainage, Cultivated lands, Land tenure, Leases, Damages, Drainage effects, Crops, Real property, Administrative agencies.

Plaintiff sought to recover damages for the destruction of his growing crops caused by the construction of a levee by defendant levee district. The court held that the Louisiana constitution allows compensation for lands and improvements actually used or destroyed for levee purposes, but no such compensation is allowed for the destruction of growing crops. Consequently, the trial court's judgment for defendant was affirmed. (Price-Florida)
W71-00053

WHEATLEY V CITY OF FAIRFIELD (DAMAGES CAUSED BY IMPOUNDED WATERS).
10A
264 NW 906-915 (Iowa 1936).

Descriptors: *Iowa, *Condemnation, *Flood damage, *Impounded waters, Administrative decisions, Boundaries (Property), Community development, Eminent domain, Judicial decisions, Land tenure, Legal aspects, Local governments, Proprietary power, Public rights, Riparian land, Riparian rights, Relative rights, Watercourses (Legal), Damages, Flooding, Impoundments, Dams, Reservoirs, Streams, Adjudication procedure, Remedies.
Identifiers: *Res judicata.

Defendant city erected a dam downstream from plaintiff's property. Water impounded thereby flooded plaintiff's land. Plaintiff brought action for damages and equitable relief. Before the case reached trial, defendant initiated condemnation proceedings against the flooded portion of plaintiff's land. The two suits were consolidated for trial. In the condemnation proceedings, plaintiff offered proof only as to the before and after value of the land, and was granted an award based thereon. The judgment directed defendant to pay the award or be enjoined from any use of the dam and the waters impounded thereby. Defendant then abandoned the condemnation proceeding and drained plaintiff's land. Plaintiff then sought an award for depreciation in rental value and damages to the land caused during the 3 year period in which defendant operated the dam. The court held that the issue of damages was res judicata in that an adjudication is final not only as to the matter actually determined, but as to every other matter the parties might have litigated which was essentially connected to the subject matter of litigation. Plaintiff's failure to prove these damages at trial barred any further action. (Clarke-Florida)
W71-00056

CITY OF CORAL GABLES V CRANDON (ESTABLISHMENT OF WATER CONSERVATION DISTRICT).

25 So 2d 1-3 (Fla 1946).

Descriptors: *Florida, *Cities, *Public benefits, *Water conservation, Municipal water, Local governments, State governments, Legislation, Water supply, Water table, Water yield improvement, Water quality, Salinity, Water pollution, Saline water, Infiltration, Saline water intrusion, Legal aspects, Judicial decisions, Water policy, Water management (Applied).

Plaintiff city brought action to enjoin the enforcement of a state act relating to the creation of water conservation districts in counties having a population of greater than 260,000. Plaintiff argued the act should be struck down since it was in effect a local law in that only Dade County contained such a large population. Plaintiff contended that such a law was invalid under the Florida constitution. The supreme court rejected the contentions, holding that the law had a reasonable basis in the subject regulated. The court took judicial notice of the fact that several other counties were approaching the 260,000 mark. The court also recognized that providing an ample supply of fresh water in Dade County had become a serious problem with population increases, increased consumption, excessive runoff problems and salt water invasion of fresh water areas. The object of the statute to restore fresh water levels was not prohibited by any constitutional barriers. (Hubener-Florida)
W71-00062

JEFFERSON REALTY CO V BD OF COMM'R OF EVERGLADES DRAINAGE DIST (VALIDITY OF DRAINAGE DISTRICT TAXES ON SOVEREIGN LANDS).
23 So 2d 274-276 (Fla 1945).

Descriptors: *Florida, *Ownership of beds, *Taxes, *Land reclamation, Meanders, Beds, Assessments, Land use, Land tenure, Land classification, Drainage districts, Land development, Boundaries (Property), Legal aspects, Judicial decisions, Lakes, Legislation, State governments, Local governments, Relative rights.
Identifiers: *Sovereignty lands.

In 1925 the Trustees of the Internal Improvement Fund conveyed to plaintiff's predecessor in title certain sovereignty lands underlying Lake Okeechobee. The state contracted with the vendee for the reclamation of the lands, which was accomplished by 1935. In 1927 and thereafter the county tax assessor placed the lands on defendant drainage district's tax rolls and made certain assessments. Plaintiff declined to pay such assessments, and brought suit to determine their validity. Defendant contended that on reclamation the lands became subject to taxation pursuant to an omnibus clause in a state act authorizing drainage district taxes on 'all other lands', i.e. lands not falling within certain prescribed categories in drainage districts. The Florida Supreme Court, in holding for plaintiff, stated that no basis existed for taxing the reclaimed lands. The omnibus phrase applied to land remote from drainage works and not to sovereignty lands below the meander line of the lake. (Hubener-Florida)
W71-00074

IDEAL FARMS DRAINAGE DIST V CERTAIN LANDS (PUBLIC POLICY ON DRAINAGE DISTRICT ASSESSMENTS).

19 So 2d 234-240 (Fla 1944).

Descriptors: *Florida, *Drainage districts, *Taxes, *Assessments, Public benefits, Public health, Social aspects, Legal aspects, Judicial decisions, Canals, Ditches, Dams, State governments, Local governments, Legislation, Swamps, Marshes, Overflow, Relative rights, Adjudication procedure.

Plaintiff drainage district brought suit to foreclose a lien for drainage taxes. Defendant interposed a defense of a three year statute of limitations on the theory that the tax was a liability created by statute. The trial court held for defendant and the supreme court affirmed. On rehearing the supreme court reversed. The court held that the state had the power to authorize or require local improvements to promote public health and welfare and to provide for canals, drains and drainage districts to implement such purposes. Where one statute provided that delinquent taxes constituted a lien until paid and another provided that actions on liens must be brought within three years, it was the court's duty to define a reasonable field of operation for the statutes, to harmonize them and to effect legislative purposes. Since laws affecting public policy and general welfare should be given liberal construction, the court held the three year limitation inapplicable in the instant case. (Hubener-Florida)
W71-00075

REALTY OPERATORS, INC V STATE MINERAL BD (OWNERSHIP OF LAKE BED).
202 La 398, 12 So 2d 198-203 (1942).

Descriptors: *Louisiana, *Ownership of beds, *Patents, *Navigable waters, Non-navigable waters, Lakes, Land tenure, Leases, Exploitation, Mineralogy, Legislation, Legal aspects, Judicial decisions, State governments, Surveys, Beds under water, Land reclamation, Relative rights, Boundaries (Property), Administrative agencies, Remedies.

Plaintiff sought an injunction to prevent the State Mineral Board from granting a mineral lease to the bed of a certain lake. Plaintiff claimed ownership of the lake and its bed by patents acquired at a sheriff's sale. Plaintiff averred that the lake was non-navigable and that it had enjoyed possession of such lake for 20 years. Defendant contended that the lake had formerly been navigable and that title to the bed remained vested in the state and could not have been conveyed by the patents. The Louisiana Supreme Court affirmed the trial court's permanent injunction against issuance of the lease. The court treated the case as an action to establish title rather than protect possession. The court held that the patents covered the bottom of the lake in question. Defendant's right to question the validity of the patents had been foreclosed by failure to file suit within six years of the enactment of an act which made patents issued to beds of lakes or other waterbodies subject to annulment. (Hubener-Florida)
W71-00076

MISSISSIPPI STATE HIGHWAY COMM'N V HUDGINS (EVALUATION OF PROPERTY TAKEN BY CONDEMNATION).
181 So 719-720 (Miss 1938).

Descriptors: *Mississippi, *Condemnation value, *Compensation, *Evaluation, Eminent domain, Judicial decisions, Legal aspects, Reservoirs, Springs, Spring waters, Local governments, Real property, Property values, Administrative agencies, Condemnation.

In a condemnation proceeding by plaintiff commission, an award was granted to defendant which included not only an amount for the value of the property, taking into consideration that a spring fed into it, but also an additional amount for the alleged value of the spring. From this award, plaintiff appealed. The court held that in such a proceeding it is not proper, after awarding full damages for property taken, to then allow additional compensation for those things without which the property would have had a lesser value. Thus it was error to allow an additional amount for the value of the spring. The judgment was affirmed with remittitur. (Price-Florida)
W71-00079

MISSISSIPPI STATE HIGHWAY COMM'N V YELLOW CREEK DRAINAGE DIST (BRIDGE CONSTRUCTION ENJOINED AS BEING IN-

TERFERENCE WITH MAINTENANCE OF DRAINAGE DISTRICT).
180 So 749-752 (Miss 1938).

Descriptors: *Mississippi, *Drainage districts, *Bridge construction, *Competing uses, Eminent domain, Drainage, Drainage practices, Drainage programs, Drainage systems, Canals, Bridge design, Piers, State governments, Highways, Cultivated lands, Public benefits, Right-of-way, Easements, Obstruction to flow, Overflow, Judicial decisions, Legal aspects, Relative rights.

Plaintiff highway department sought to restrain defendant drainage district from interfering with the construction of a bridge by plaintiff across a canal which was part of a drainage system maintained by defendant. Plaintiff, in a cross-bill filed by defendant, was restrained from constructing said bridge. On appeal plaintiff alleged the bridge was being built in the same place a previous bridge had been, that it was being properly constructed and that it was causing no more obstruction in the canal than existed previously. Defendant alleged that the bridge was being improperly constructed and that increased obstruction to the canal would result due to plaintiff's placing of piers in the canal. The court confirmed the lower court's findings that the bridge as constructed would collect drift and damage agricultural land in the district. Both parties had powers of eminent domain. Defendant owned the right-of-way through which the canal ran. Property already devoted to public use may be again taken or damaged for public use if the public interest is served and the prior use is not materially impaired. Here, both public purposes, highway construction and the maintenance of drainage districts, could be served without significant damage to either if no piers were placed in the canal. The judgment for defendant was affirmed. (Price-Florida)
W71-00081

STATE V STOUTAMIRE (RIGHT OF PEOPLE TO TAKE FISH FROM PUBLIC WATERS OF THE STATE).
179 So 730-734 (Fla 1938).

Descriptors: *Florida, *Fish conservation, *Fishing, *Public rights, Legislation, State governments, Public benefits, Freshwater fish, Fish, Fish behavior, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power), Relative rights.

The Florida legislature had passed a law prohibiting the taking of fish from a certain one half mile length of a fresh water river in Northwest Florida. Plaintiff, in a habeas corpus proceeding, contended that the law was local or special in nature and as such was invalid since its passage had failed to comply with Florida constitutional requirements pertaining to such laws. Defendant sheriff contended that the law was a general law. The court stated that the right of the state in the fish of public waters is a sovereign right of preservation, conservation and regulation, but not an absolute right such as the state has in its proprietary property. The people have a right to take fish from public waters subject to such regulation. The court held the statute in question was a special law, the passing of which had not met certain constitutional requirements. Consequently the statute was invalid and could not be enforced. (Price-Florida)
W71-00082

HENRITZY V HARRISON COUNTY (RIGHT OF WAY SECURED VIA CONDEMNATION FOR SEA WALL CONSTRUCTION).
178 So 322-327 (Miss 1938).

Descriptors: *Mississippi, *Sea walls, *Right-of-way, *Condemnation, Eminent domain, Local governments, Easements, Landfills, Compensation, Judicial decisions, Legal aspects, Legislation, Damages, Adjudication procedure, Washouts, Surveys.

Defendant had been required to remove a concrete structure from a right-of-way which had been secured by plaintiff county for the construction of a sea wall which was designed to protect a highway from storm damage. Defendant contended the condemnation proceeding through which the right-of-way had been secured had been unconstitutionally conducted. The court found that the procedure for condemnation had been followed properly, and that the statute of limitations was a bar to any claim for damages by defendant if he in fact had ever had a right to such claim. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-00083

STUART V DETROIT FINNISH COOPERATIVE SUMMER CAMP ASS'N (INTERFERENCE WITH WATER LEVEL).
277 Mich 144, 269 NW 122-124 (1936).

Descriptors: *Michigan, *Riparian rights, *Dams, *Water levels, Legal aspects, Judicial decisions, Water law, Backwater, Overflow, Water level fluctuations, Water, High water mark, Lakes, Obstruction to flow, Prescriptive rights, Reasonable use, Recreation, Natural flow doctrine, Competing uses, Relative rights, Riparian waters, Riparian land.

Defendant association's property surrounded a lake containing a spring whose waters flowed into a chain of small lakes some three-quarters of a mile distant. Plaintiffs, who owned land on the chain of lakes, built a dam which raised the level of defendant's lake 1 1/2-2 feet. When defendant began to construct a drain to lower the water level, plaintiffs brought action to enjoin such construction. Defendant then filed a cross-bill seeking to enjoin plaintiffs' maintenance of their dam so as to raise the water level of its lake. Defendant contended that plaintiffs could not construct a dam which interfered with defendant's enjoyment of its property. Plaintiffs contended that defendant was barred by laches because it allowed construction of the dam and subsequent development of surrounding property without complaint. The court held that plaintiffs had not acquired a prescriptive right to operate a dam because their dam had not been in existence the requisite period of years. Mere passivity by defendant, in the absence of a duty to speak, did not stop it from complaining when the actions of plaintiffs interfered with its enjoyment of its property. The court enjoined plaintiffs from raising the water in defendant's lake beyond its original level. (Dye-Florida)
W71-00084

CITY OF NEW LISBON V HAREBO (CONDEMNATION PROCEDURE FOR DAM CONSTRUCTION).
271 NW 659-664 (Wis 1937).

Descriptors: *Wisconsin, *Condemnation, *Eminent domain, *Local governments, Legislation, Judicial decisions, Legal aspects, Dams, Political aspects, Damsites, Backwater, Damages, Flow, Recreation, Public benefits, Public lands, Cities, Navigable waters, Artificial use, Rivers, Streams, Ponds, Lakes, Reservoirs, Permits.

Petitioner city sought to condemn property for construction of a dam and reservoir to be used as a recreational park. Respondent landowners demurred on the grounds that: (1) the public necessity for condemnation was not shown; and (2) the petition did not allege that a permit had been obtained for construction of the dam. Petitioner contended that a permit could not be obtained until the property to be flowed was acquired, since applicants for permits must show that no property damage will result from dam operation. The Supreme Court of Wisconsin ruled for respondent, stating that property damage contemplated by regulations governing issuance of permits is damage in time of flood, not normal flowage. Property may not be condemned until the public purpose for which it is being acquired is shown to be legal and imminent. Without a permit, construction of the dam would be illegal and the public purpose could not be effectuated. The court also found the petition defective in not alleging why it was necessary to condemn the particular property involved. (Dye-Florida)
W71-00085

WARREN V GEORGIA POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER FROM DAM).
197 SE 338-342 (Ga Ct App 1938).

Descriptors: *Georgia, *Hydroelectric plants, *Backwater, *Flood damage, Dams, Compensation, Damages, Remedies, Legislation, Condemnation, Eminent domain, Cultivated lands, Public utilities, Rivers, Drainage, Ditches, Silts, Sediments, Riparian land, Riparian rights, Public rights, Legal aspects, Judicial decisions, Adjudication procedure.
Identifiers: Nuisance.

Plaintiff landowner brought a nuisance action against defendant power company for damages to plaintiff's land allegedly caused by the backwater from defendant's dam. Plaintiff contended that defendant negligently operated and maintained the dam and caused the river to fill with silt and sediment, thereby impairing the drainage of plaintiff's land and rendering it unfit for cultivation and diminishing its rental value for the previous four years. Defendant contended that the evidence failed to disclose any negligence on defendant's part, and that the damage to plaintiff's land was permanent and had occurred more than four years ago; therefore, plaintiff's action was barred by the statute of limitations. Affirming a judgment of nonsuit, the court held that the evidence showed a taking and damaging of the property for public use rather than a continuing nuisance, but plaintiff could not recover the just compensation to which he was entitled for such a taking in a nuisance action. Further, the court noted that where damage is of a permanent nature, an action for continuing nuisance is improper and can be barred by the statute of limitations. (Liptak-Florida)
W71-00086

SATREN V HADER CO-OPERATIVE CHEESE FACTORY (ABATEMENT OF NUISANCE CAUSED BY DISCHARGE OF INDUSTRIAL WASTE).

279 NW 361-364 (Minn 1938).

Descriptors: *Minnesota, *Water pollution sources, *Pollution abatement, *Industrial wastes, Water pollution, Judicial decisions, Legal aspects, Legislation, Pollutants, Riparian rights, Wastes, Decomposing organic matter, Sewage, Streams, Dairy industry, Milk, Path of pollutants, Water pollution control, Water pollution effects, Abatement, Industrial plants, Industrial water.

Defendant operated a cheese factory, dumping sewage and whey into a creek which flowed adjacent to his property and through plaintiff's property. Plaintiff brought action to enjoin such dumping. A trial court adjudged the dumping a nuisance and enjoined defendant from dumping sewage and whey. On appeal, defendant contended that: (1) regulation of water pollution is the State Board of Health's responsibility, not the courts; and (2) plaintiff's damages ($63 a year) were too insignificant to warrant an injunction. Plaintiff contended that the statute giving the Board of Health authority over water pollution does not prevent the courts from abating private nuisances under prior statutes. The Supreme Court of Minnesota affirmed, ruling that the cheese factory had obtained no prescriptive right to dump whey because its dumping was neither continuous nor homogeneous for the required time period. The insignificance of the damage to plaintiff was immaterial to issuance of an injunction. However, only that activity which was shown to have been injurious to plaintiff, the

dumping of whey, could be enjoined. The trial court's injunction was modified to that effect. (Dye-Florida)
W71-00087

KELLOG V HOTTMAN (INTERFERENCE WITH FLOW OF FLOODWATERS).
286 NW 415-417 (Iowa 1939).

Descriptors: *Iowa, *Flood protection, *Flood routing, *Dikes, Judicial decisions, Legal aspects, Flood control, Diversion, Diversion structures, Levees, Flooding, Rivers, River flow, Floods, Floodwater, Running waters, Streams, Obstruction to flow, Alteration of flow, Arable land, Missouri River, Repulsion (Legal aspects).

Plaintiff's property was surrounded on three sides by dikes of his own construction which prevented the waters of the Missouri River from inundating his land in time of flood. On the fourth side ran an elevated road. Defendant landowners constructed a dike along a portion of this road, and at a somewhat higher level, for the purpose of diverting the course of floodwaters. Plaintiff complained that the new construction would raise the level of floodwaters around his property and would prevent waters which entered his property from escaping. A lower court denied plaintiff's request for an injunction restraining construction of defendant's dike. The Supreme Court of Iowa affirmed. The evidence did not support plaintiff's allegation of interference with the course of floodwaters around plaintiff's property. Plaintiff's dike had been sufficient to protect his land from flood waters for years and there was no proof of the possibility of an extraordinary flood in the foreseeable future. (Dye-Florida)
W71-00089

ARND V HARRINGTON (TITLE BY ACCRETION VERSUS TITLE BY ADVERSE POSSESSION).
287 NW 292-296 (Iowa 1939).

Descriptors: *Iowa, *Land tenure, *Accretion (Legal aspects), *Prescriptive rights, Boundaries (Property), Boundary disputes, Missouri River, Adjudication procedure, Judicial decisions, Jurisdiction, Rivers, Interstate rivers, Bank erosion, Evulsion, Real property, Water rights, Remedies, Legal aspects, Riparian land, Riparian rights, State jurisdiction.

Plaintiff and defendant both claimed title to land created by accretion along the Missouri River. Plaintiff sued defendant for trespass, asking for an injunction to prevent defendant's interference with his use of the land and for damages. Defendant cross-claimed to quiet title and also sought a similar injunction. Plaintiff claimed title by adverse possession. Defendant claimed title by accretion formed by the changing course of the Missouri River, and argued that the complaint erroneously described the land as being in Nebraska when it actually was located in Iowa. Affirming a judgment for plaintiff, the court held that the evidence clearly established title in plaintiff by adverse possession. As to the description of the land, the court found that there was no question as to the identity of the tract in controversy and, although state boundaries may change as a result of accretion, the court has jurisdiction as long as the land is actually within the state at the time and all the parties are before the court. (Liptak-Florida)
W71-00090

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'N (ADMINISTRATIVE ORDER TO SUPPLY WATER).
287 NW 682-683 (Wis 1939).

Descriptors: *Wisconsin, *Administrative decisions, *Community development, *Water supply, Equitable apportionment, Judicial decisions, Legal aspects, Local governments, Preferences (Water rights), Public benefits, Relative rights, State governments, Water rights, Public utilities, Public utility districts, Conduits, Remedies.

Defendant Public Service Commission entered an order granting authority to defendant Town of Greenfield to construct water mains which would ultimately allow the Town of Greenfield to obtain its water from defendant City of West Allis. Plaintiff City of Milwaukee brought this action to set aside said order, contending that it furnished water to the City of West Allis, and if the plans were carried out, the necessary water might ultimately be supplied by plaintiff. The court dismissed the action, holding that the mere construction of the water mains was no concern of the plaintiff. If and when the Public Service Commission ordered the City of West Allis to supply water to the Town of Greenfield, plaintiff would have standing to bring an action. (Clarke-Florida)
W71-00091

DETROIT TRUST CO V DINGMAN (AUTHORITY OF DRAINAGE DISTRICTS TO ALLOW INCIDENTAL SEWAGE DISPOSAL THROUGH DRAINAGE SYSTEM).
291 Mich 170, 289 NW 118-122 (1939).

Descriptors: *Michigan, *Drainage systems, *Drains, *Sewage disposal, Judicial decisions, Legislation, Legal aspects, Drainage, Subsurface drainage, Surface drainage, Drainage programs, Multiple-purpose projects, Surface waters, Drainage districts, Governments, Sewers, Conduits, Administration, Local governments, Sewage, Drainage water, Surface runoff, Drainage engineering, Drainage practices.

Drains disposing of surface water and sewage were constructed in a drainage district where plaintiffs were taxpayers. Plaintiffs sought an injunction restraining defendant drainage district from assessing drainage taxes to pay for construction of the drains on the grounds that the drainage structures were sewers and not within the authority of the drainage district to construct. The lower court ruled for plaintiffs. The Supreme Court of Michigan reversed, stating that a structure may retain its character as a drain though incidentally disposing of sewage. Testimony showed that the structure in the instant case were designed on the basis of the volume of runoff water flow and only incidentally to dispose of sewage. Michigan statutes allow the incidental use of drains for sewage disposal. Location of parts of the drain beneath the ground did not change its character. (Dye-Florida)
W71-00092

WHITE V WELSH (AUGMENTATION OF UTILITY CAPACITY).
291 Mich 636, 289 NW 279-281 (1939).

Descriptors: *Michigan, *Legislation, *Water supply, *Water sources, Judicial decisions, Legal aspects, Cities, Pipes, Lakes, Inter-basin transfers, Pipelines, Water conveyance, Water delivery, Public utilities, Facilities, Local governments, Administration, Conduits, Utilities, Water works, Water distribution (Applied), Regulation.

Plaintiff taxpayers sought to restrain defendant city of Grand Rapids from constructing a water pipe to Lake Michigan to transport water to the city's water system. Plaintiffs contended that the construction would violate a statute prohibiting acquisition by a city of a public utility without consent of the electors. The lower court dismissed the complaint, saying that the pipeline construction was an extension of an existing utility rather than the acquisition of a new one. The Supreme Court of Michigan affirmed, citing as authority a previous case in which a city was allowed to purchase a complete power plant to augment existing power sources. In the instant case the proposed construction was a pipeline whose only use was to be in conjunction with the existing city water system. Consequently, defendant had not violated the statute. (Dye-Florida)
W71-00093

KUEHN V VILLAGE OF MAHTOMEDI (CONFLICT BETWEEN PUBLIC AND PRIVATE OPERATORS OF WATER SYSTEMS).
292 NW 187-191 (Minn 1940).

Descriptors: *Minnesota, *Community development, *Local governments, *Public rights, Equitable apportionment, Human population, Judicial decisions, Legal aspects, Permits, Relative rights, Third party effects, Water transfer, Potable water, Pipes, Pipelines, Municipal water, Water supply, Water distribution (Applied).
Identifiers: *Dedication, *Negligence.

Plaintiff constructed a water plant and pipes for the purpose of selling water to private customers. Several years later, defendant village of Mahtomedi was incorporated, following which defendant constructed its own water plant and lines, many of which paralleled plaintiff's. Plaintiff sued for damages, alleging three grounds: (1) the mere establishment of his water system constituted a perpetual franchise by statute; (2) a plat describing a dedication of a section of the town reserved to him the exclusive right to lay and maintain water pipes in that section; and (3) defendant negligently damaged his pipes. The court held as to the first contention that the statute in question concerned the use of public roads for enterprises developing water power. Plaintiff's business of selling water was not included within the scope of the statute. Secondly, the court held that a dedicator of land may not attach to the dedication limitations which remove the land from public control. Such limitations are void as against public policy. As to the third contention, the statute of limitations for filing negligence actions against a municipality had run. (Clarke-Florida)
W71-00094

VANDREUIL LUMBER CO V EAU CLAIRE COUNTY (CONDEMNATION OF FLOWED LANDS).

239 Wis 538, 2 NW2d 356-362 (1942).

Descriptors: *Wisconsin, *Eminent domain, *Dams, *Condemnation, Judicial decisions, Legal aspects, Legislation, Recreation, Reservoirs, Taxes, Governments, Federal government, Local governments, Government finance, Flow, Flooding, State governments, Administration, Administrative decisions, Real property.

Defendant county constructed a dam which, in operation, flowed plaintiff corporation's property. Subsequent to the dam's construction, a statute was enacted empowering the county to condemn property which was to be flowed by dams constructed under county-sponsored work projects. Plaintiff objected to the condemnation of its land because: (1) enactment of the condemnation statute was after construction of the dam which flowed its land; and (2) administrative requirements for condemnation had not been fulfilled. Defendant contended that the statute applied to any dam, regardless of when constructed. The Supreme Court of Wisconsin found for defendant, and held that all procedural requirements for condemnation had been compiled with. The fact that defendant was acquiring some flowed lands by lease did not require it to acquire all land that way. A county may use whatever means it deems most efficient to acquire flowed lands. (Dye-Florida)
W71-00095

LAGE V POTTAWATTAMIE COUNTY (FLOOD DAMAGE RESULTING FROM PUBLIC ACTIVITY).
5 NW2d 161-167 (Iowa 1942).

Descriptors: *Iowa, *Flooding, *Eminent domain, *Local governments, Judicial decisions, Legislation, Legal aspects, Flood damage, Condemnation, Dikes, Banks, Highways, Embankments, Road-

banks, Drains, Levees, Drainage districts, Governments, State governments, Floods, Cost allocation, Property values, Land forming, Compensation.

Plaintiff's property was damaged by intermittent flooding caused by defendant county's cutting of the banks and dikes of a drainage ditch. The bank cutting was done in the course of the purchase of fill dirt from plaintiff by defendant for the purpose of raising the level of a state highway which ran adjacent to plaintiff's property. Plaintiff alleged that the flooding of his property was a taking by government of his property without just compensation. Plaintiff claimed to be entitled to the value of his property before flooding. The Supreme Court of Iowa held that where a public structure necessarily leads to the flooding of private land, there is a taking of property requiring compensation. That defendant was performing a duty in improving the highway did not relieve defendant of responsibility. Payment for the fill dirt did not contemplate further damage to plaintiff's property and was not compensation for such damage. (Dye-Florida)
W71-00096

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'M (PUBLIC UTILITIES REGULATION).
5 NW2d 800-804 (Wis 1942).

Descriptors: *Wisconsin, *Public utilities, *Local governments, *Water supply, Judicial decisions, Legislation, Legal aspects, Governments, Utilities, Public utility districts, Water distribution (Applied), Administration, Institutions, Regulation, Water works, Water rates, Cities, Water demand, Water management (Applied), Administrative agencies, Administrative decisions.

Plaintiff city operated a water works utility. By contract with defendant town the city agreed to supply water to a limited portion of the town. Defendant Public Service Commission ordered the city to extend service to the remainder of the town on the theory that by servicing part of the town it had become a utility for the entire town under the direction of the Commission. The trial court held for the Commission. The Supreme Court of Wisconsin reversed. The issue was whether a municipal uility, by accepting a contract to service a limited area of a town, becomes a utility for the entire town. Plaintiff, by extending its service, became a utility outside the city only to the extent of its contract. Plaintiff could be required to continue to service the area contracted for, but could not be required to extend its services to the entire town. (Dye-Florida)
W71-00098

STATE EX REL PETERSON V BENTLEY (COMPENSATION FOR TAKING OF PRIVATE PROPERTY REQUIRED).
12 NW2d 347-359 (Minn 1943).

Descriptors: *Minnesota, *Eminent domain, *Compensation, *Flooding, Condemnation, State governments, Governments, Legislation, Judicial decisions, Legal aspects, Political aspects, Dams, Jurisdiction, State jurisdiction, Flow, Reservoirs, Standing waters, Backwaters, Administration, Administrative decisions, Damages, Flood damage, Dam construction.

Petitioners sought to intervene in a suit brought by the state to condemn lands to be used for a dam and reservoir. Petitioners claimed that their land would be flooded by the proposed dam to the extent of a taking by the state, and sought just compensation for the property. The state claimed that petitioners were improper parties to the action. The Supreme Court of Minnesota found for petitioners. The state may take private lands only for a public use and only after paying just compensation. Flooding of private property is a taking and requires compensation. The amount of compensation is a judicial question. It is immaterial that insufficient funds were appropriated by the legislature to compensate petitioners. Compensation must be made. The court in its discretion may allow petitioners to intervene even though they have not fulfilled the requirements of the intervention statute. Where the state has not changed its position in reliance on petitioners' inaction, laches does not apply. (Dye-Florida)
W71-00106

MCCAULEY V SALMON (RELATIVE RIGHTS OF RIPARIAN OWNERS AND THE PUBLIC ALONG NAVIGABLE WATERS).
14 NW2d 715-716 (Iowa 1944).

Descriptors: *Recreation, *Iowa, *Riparian rights, *Navigable waters, Judicial decisions, Navigable rivers, Bodies of water, Rivers, Streams, Boundaries (Property), River beds, Ownership of beds, Riparian waters, Legal aspects, Streambeds, Boats, Boating, Water sports, Reasonable use, Competing uses, Relative rights, Riparian land, Watercourses (Legal), Navigation.

Defendants operated motorboats on a river. Plaintiff owned lands along the river and sought to enjoin as a nuisance the operation of boats on the river with unreasonable noise and at high speeds. The river adjacent to plaintiff's property was a navigable stream deepened by a dam constructed with the consent of riparian owners. Its primary use was recreational and boats operating on the river were licensed by the state. The trial court granted relief as to noise but not as to speed. The Supreme Court of Iowa affirmed. Riparian owners own only to the high water marks of navigable streams. The right of the public to navigate such streams is paramount, including rights of boating and other sports. The shores are subject to dangers incident to reasonable exercise of the navigation right. Damages resulting from such reasonable navigation must be borne by the owners of riparian land. So long as boats navigating the river did not exceed the statutory speed limit, no regulatory action would be taken. (Dye-Florida)
W71-00109

JOHNSON V STARR (NEGLIGENT DAM CONSTRUCTION).
191 SE 874-875 (Ga Ct App 1937).

Descriptors: *Georgia, *Dam failure, *Flood damage, *Impounded waters, Dams, Storm drains, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Relative rights, Riparian land, Riparian rights, Riparian waters, Streams, Remedies, Damage, Overflow, Flooding, Construction, Dam construction.

Defendant constructed an earthen dam across a stream flowing through his land. There were no storm drains installed therein. During a heavy rain, the dam collapsed. Plaintiff claimed that his land was flooded by the overflow of the stream caused by the breaking of the dam, and brought action to recover for damages caused by such flooding. Defendant admitted all the facts but contended that plaintiff's land was already flooded when the dam broke. The trial court placed the burden of proof on defendant as to his nonnegligence in constructing the dam. The appellate court reversed, holding that the burden was on plaintiff to sustain his allegations of negligence. (Clarke-Florida)
W71-00126

FINSETH V SPERRY (MAINTENANCE OF DRAINAGE SYSTEMS).
17 NW2d 499-502 (Minn 1945).

Descriptors: *Minnesota, *Drainage districts, *Cost allocation, *Local governments, Judicial decisions, Legal aspects, Legislation, Drains, Costs, Cost sharing, Maintenance costs, Financing, Drainage, Governments, Ditches, Drainage systems, Taxes, Obstruction to flow, Repairing, Administration, Management, Operation and maintenance, Maintenance.

Plaintiffs were owners of land drained by one of eleven branches of a judicial ditch system. The drain became obstructed by soil and vegetation. Plaintiffs sought to have the ditch cleaned by defendant drainage district under a statute obligating drainage districts to clean and repair their facilities on petition when the cost of such maintenance is less than 30 per cent of the cost of construction. Defendant contended that such maintenance was required only to benefit the entire system, not when a small part of the system needed repair. The Supreme Court of Minnesota held for plaintiffs. If defendant lacked sufficient funds to maintain the drain, plaintiffs were entitled to have the cost of cleaning and repairs assessed against all property within the district in the same proportion as costs of the original construction. The county board was obligated to keep in repair and unobstructed the entire judicial ditch system of the county. (Dye-Florida)
W71-00147

POOVEY V CITY OF HICKORY (CITY'S LIABILITY FOR WATER POLLUTION RESULTING FROM SEWAGE DISPOSAL).
210 NC 630, 188 SE 78-81 (1936).

Descriptors: *North Carolina, *Water pollution, *Compensation, *Sewage disposal, Remedies, Streams, Sewage, Adjudication procedure, Legal aspects, Local governments, Cities, Judicial decisions, Riparian rights, Waste disposal, Eminent domain, Condemnation, Municipal wastes, Water pollution control, Water quality, Water quality control, Treatment facilities.

Plaintiff landowner brought an action for nuisance and to recover damages from defendant city as a result of defendant's practice of dumping raw sewage into a creek which ran through plaintiff's property. Plaintiff contended that defendant's sewage disposal plant was wholly inadequate for the city's expanded population and asked for an injunction restraining defendant from operating the inadequate plant after a reasonable time. Plaintiff further sought damages for temporary injury to her property as well as for permanent injury, claiming a taking of her property under defendant's eminent domain powers. Defendant contended that the complaint was improper and moved to strike all references to defendant's increased population and financial ability as irrelevant and prejudicial. Reversing an order granting defendant's motion, the court held that, since defendant admitted the truthfulness of the allegations, it could not be said as a matter of law that the truth was irrelevant or prejudicial to defendant's case. The court also noted that it was entirely proper for plaintiff to seek to abate a nuisance in the same action in which damages were sought. (Liptak-Florida)
W71-00162

SINK V CITY OF LEXINGTON (LIABILITY FOR DAMAGE CAUSED BY BACKWATER FROM MUNICIPAL DAM).
214 NC 548, 200 SE 4-5 (1938).

Descriptors: *North Carolina, *Dams, *Backwater, *Flood damage, Natural flow doctrine, Riparian land, Riparian rights, Riparian waters, Water rights, Public rights, Remedies, Adjudication procedure, Judicial decisions, Legas aspects, Local governments, Watercourses (Legal), Ditches, Drainage effects, Drainage water, Surface drainage, Municipal water, Public utilities, Reasonable use, Cultivated lands, Beneficial use.

Plaintiff farmer brought action against defendant city and city utility commission for damages to his land resulting from the construction of a dam as part of the municipal water system. The backwater of the dammed creek reached to within 600 feet of plaintiff's farm which was located above the reservoir. Plaintiff contended that prior to the dam construction, a creek had provided drainage for his property, allowing him to use the land for cultivation and pasture, but that since the dam construc-

tion the land could not drain, was usually standing in water and was therefore unfit for cultivation. Defendant denied liability. Revising a judgment of nonsuit, the court held that plaintiff's evidence was sufficient to have the case submitted to the jury. The court noted that a riparian owner has a right to have the streamflow maintained as its natural flow and to use the water for domestic, manufacturing and other purposes subject only to the equal rights of beneficial use of other riparian owners. (Liptak-Florida)
W71-00206

SILAS MASON CO V TAX COMM'N OF WASHINGTON (STATE'S RIGHT TO TAX FEDERAL GOVERNMENT'S CONTRACTORS).
302 US 186, 58 Sup Ct 233-245 (1937).

Descriptors: *Washington, *Taxes, *Federal reclamation law, *Federal jurisdiction, Grand Coulee Dam, Columbia River, State jurisdiction, Legislation, Permits, Regulation, Judicial decisions, Governments, Federal government, State governments, Legal aspects, Contracts, Navigable rivers, Ownership of beds, Damsites, Dam construction, United States.
Identifiers: *Reclamation Act.

Plaintiff contractors brought suit to restrain the enforcement of the Occupation Tax Act of the State of Washington as applied to gross income they received for work performed in connection with the building of the Grand Coulee Dam on the Columbia River. The Washington supreme court upheld the tax and plaintiffs appealed. The United States Supreme Court stated that the questions presented were whether the tax imposed an unconstitutional burden on the federal government and whether the areas in which plaintiffs' work was performed were within the exclusive jurisdiction of the United States. The Supreme Court held that the tax did not impose an unconstitutional burden. The Court also held that the acquistion title to land for construction of the dam did not confer exclusive jurisdiction upon the United States unless the state had also transferred all residual jurisdiction to the United States. The state could retain jurisdiction over the areas owned by the United States for purposes not inconsistent with federal functions and could tax certain activities which Congress had permitted to remain subject to state licenses, permits and building and health regulations. (Hubener-Florida)
W71-00213

UNITED STATES V FLOWER (DISPUTE TO LAND CREATED BY AVULSION).

108 F2d 298-302 (8th Cir 1939).

Descriptors: *Iowa, *Nebraska, *Avulsion, *Accretion (Legal aspects), Bank erosion, Boundaries (Property), Boundary disputes, Rivers, Alluvium, Missouri River, Meanders, River beds, Ownership of beds, River flow, Riparian rights, Relative rights, Legal aspects, Judicial decisions, Federal government, Federal jurisdiction, Indian reservations, United States.

The United States brought suit on behalf of the Winnebago Indian Tribe to recover 4000 acreas of land which lay in the Missouri River bottom. Defendant contended that an avulsive action in the 1870's had caused the main channel of the river to shift towards Iowa, leaving land originally in Iowa on the Nebraska side of the river. Because of this avulsive change, defendant maintained that the land between the old and the new channels would remain part of Iowa. Plaintiff claimed title to the land as accretions to its holdings in Nebraska. The Court of Appeals, Eighth Circuit, affirmed the district court's holding that the western boundary of Iowa would remain in the middle of the channel of the Missouri River as of the time Iowa was admitted to the Union. Thus the land separated from Iowa by avulsion in the 1870's remained part of Iowa. The court held, however, that government was entitled to claim land forming the former channel bottom up to the middle of the former channel. (Hubener-Florida)
W71-00234

BD OF LEVEE COMM'RS FOR YAZOO-MISSISSIPPI DELTA V WITHERS (CONDEMNATION AND RIGHT TO CONSEQUENTIAL DAMAGES).
6 So 2d 115-117 (Miss 1942).

Descriptors: *Mississippi, *Levees, *Riparian land, *Condemnation, Condemnation value, Local governments, Dams, Embankments, Judicial decisions, Legal aspects, Relative rights, Flood control, River regulation, Compensation, Prescriptive rights, Land tenure, Riparian rights, Eminent domain, Discharge (Water), Seepage.

Plaintiff board sought to condemn a parcel of land owned by defendants which constituted part of a pond covering about 10 acres. Plaintiff had previously constructed a holding dam on its own property which caused the creation of the pond. The holding dam was to be abandoned and the pond water released. Defendants, who had enjoyed fishing and boating privileges in the pond, demanded consequential damages be awarded for loss of use of the pond. Defendants claimed that the pond had materially enhanced the value of their sites adjacent to the pond and that they were entitled to damages for the diminution in value of the sites. The court held that defendants, as riparian owners, had no right to demand permanent maintenance of the dam even though it had existed for 30 years. Consequential damages could only be awarded for the wrongful invasion of some right, and defendants had no rights to the pond or its water. (Hubener-Florida)
W71-00238

MACEDONIA BAPTIST CHURCH V CITY OF COLUMBIA (FLOODING FROM SURFACE DRAINAGE OF MUNICIPAL STREETS).
10 SE2d 350-359 (SC 1940).

Descriptors: *South Carolina, *Surface drainage, *Drainage systems, *Flood damage, Drainage, Ditches, Drainage effects, Drainage waters, Surface waters, Surface runoff, Damages, Floods, Judicial decisions, Legislation, Overland flow, Runoff, Cities, Local governments.

In an action for damages caused by surface waters which were drained from defendant municipality's streets and cast on plaintiff's land, plaintiff contended that the defendant was negligent per se in causing plaintiff's land to be flooded in that an adequate drainage system was not provided for such surface waters as required by statute. Defendant contended that any damage sustained by plaintiff resulted from causes over which defendant had no control and thus precluded defendant from liability. The court found that there was evidence to the effect that defendant had opened up ditches, cleaned sidewalks, widened roadbeds and performed other acts so as to cause the amount of water being drained to be substantially increased. The court thus held that such evidence was sufficient to establish that defendant had done such acts as to have required it to provide an adequate drainage system as called for by the statute, and upon its failure to so provide, defendant was negligent per se. The jury verdict for plaintiff was affirmed. (Snow-Florida)
W71-00239

KOONE V CAROLINA MOUNTAIN POWER CORP (NEGLIGENT OPENING OF FLOODGATES).
217 NC 286, 7 SE2d 565-566 (1940).

Descriptors: *North Carolina, *Dams, *Flood damage, *Impounded waters, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Rivers, Remedies, Damages, Dam failure, Floodgates, Overflow, Flooding, Floodwater, Excessive precipitation.
Identifiers: *Negligence.

Defendant power company constructed a dam across a stream, thus forming a lake behind the dam. Several days of rain caused the waters of the stream to become swollen and caused the level of the lake behind the dam to rise to the crest of the dam. Fearing that the dam might be swept away, defendant opened its floodgates, causing large amounts of water to flow into the already swollen stream. The stream then overflowed plaintiff's land resulting in extensive damages thereto. At trial a motion for nonsuit was granted to defendant. The Supreme Court of North Carolina reversed, holding that the evidence of the allegations of negligence in the complaint was sufficient to be submitted to the jury. (Clarke-Florida)
W71-00240

DAVENPORT V PITT COUNTY DRAINAGE DIST NO 2 (FLOODING FROM WRONGFUL CONSTRUCTION OF DRAINAGE SYSTEM).

220 NC 237, 17 SE2d 1-4 (1941).

Descriptors: *North Carolina, *Flood damage, *Overflow, *Drainage districts, Flooding, Flood water, Ponding, Drainage systems, Floods, Drainage, Ditches, Drainage effects, Drainage water, Judicial decisions, Conduits, Drainage, Engineering, Damages, Canal construction, Canals, Obstruction to flow, Legal aspects, Administrative agencies.

In an action for damage to crops resulting from overflow of a drainage ditch, plaintiff contended that defendant drainage district had negligently constructed a canal which resulted in plaintiff's lands being flooded and his crops destroyed. Plaintiff also contended that defendant had breached a contract wherein defendant had agreed to properly drain plaintiff's lands. Defendant contended that the negligence action was barred by a three year statute of limitation and that the contract was void. The court held that the flooding, though intermittent, was permanent so as to constitute a continuing trespass, and as such the cause of action accrued at the time of the initial flooding some seventeen years earlier so as not to be barred by the statute of limitations. The court further held that the contract was entered into only by the individual commissioners of the drainage district and was not the product of a formal corporate action as required by law. Consequently, the contract was invalid. Since plaintiff had no available remedy, the judgment for defendant was affirmed. (Snow-Florida)
W71-00241

HAMPTON V NORTH CAROLINA PULP CO (PRIVATE REMEDY FOR POLLUTION).
223 NC 535, 27 SE2d 538-547 (1943).

Descriptors: *North Carolina, *Water pollution, *Riparian rights, *Fisheries, Stream fisheries, Commercial fishing, Fish, Fishing, Migration, Judicial decisions, Legal aspects, Legislation, Water law, Impaired water quality, Pollutants, Reasonable use, Wastes, Water pollution effects, Chemical wastes, Industrial wastes, Relative rights, Remedies, Competing uses, Riparian waters, Streams.

Plaintiff fisheries operator brought action for damages and other relief from injuries resulting from the discharge of wastes from defendant's industrial plant downstream. Plaintiff alleged that pollution caused by defendant deterred fish from traveling upstream to plaintiff's fishery and interfered with plaintiff's livelihood. Defendant contended that any damage caused by his operation was purely public and created no cause of action in a riparian owner. The trial court dismissed the complaint, citing a case in which a fisheries owner

had been denied relief from damage caused by erection of a mill dam. The Supreme Court of North Carolina reversed, distinguishing the latter case on the grounds that operation of the mill dam was lawful, and riparian owners may not complain of private damages caused by reasonable exercise of a lawful right. In the instant case, however, pollution of the stream was in violation of state law. The court held that owners of fisheries upstream may maintain actions for wrongful interference with the migratory passage of fish whereby their fisheries are injured. It was irrelevant to the question of the peculiar nature of injury that damage was to a class of individuals. (Dye-Florida)
W71-00243

NANTAHALA POWER AND LIGHT CO V MOSS (CONDEMNATION OF RIGHT TO DIVERT RIVER FLOW).
220 NC 200, 17 SE2d 10-20 (1941).

Descriptors: *North Carolina, *Dams, *Condemnation value, *Compensation, Condemnation, Engineering structures, Rivers, River flow, Damsites, Riparian rights, Alteration of flow, Diversion, Riparian land, Riparian waters, Diversion structures, Streamflow, Diversion dams, Diversion losses, Water loss, Value, Judicial decisions.

Plaintiff power company brought a condemnation proceeding to acquire the right to divert the waters of a river which was adjacent to the lands of defendant riparian owners. Plaintiff, having constructed a dam for power purposes upstream from defendants' lands, contended that the value to be given for the property taken was to be determined on the basis of its value in the hands of defendants. Defendants contended that the value was to be determined on the basis of the enhanced value and advantages accruing to the one condemning the property and that inasmuch as the right to divert the water from the lands was indispensable to the plaintiff, such could be considered by the jury in evaluating the property. The court held that just compensation in condemnation proceedings merely required that the owner of the property taken should be paid for that taken from him and that the value of the property to the condemner for his particular use was not to be considered. (Snow-Florida)
W71-00244

DOMAN V BALTIMORE AND O RR (OVERFLOW FROM OBSTRUCTION BY BRIDGE CONSTRUCTION).
22 SE2d 703-706 (W Va 1942).

Descriptors: *West Virginia, *Obstruction to flow, *Bridges, *Alteration of flow, Railroads, Engineering structures, Rivers, Barriers, River flow, Damages, Flow, Erosion, Flood damages, Flooding, Overflow, Judicial decisions, Floods, Beds, River beds, Legal aspects.

In an action for damages, plaintiff contended that defendant railroad company, by laying the foundation of a bridge in a river bed, obstructed and altered the flow of the river in times of flood so as to cause the river to overflow and wash away plaintiff's lands abutting the river. Defendant contended that the construction of the bridge did not affect the ordinary level of the floodwaters which invaded plaintiff's land so as to be a contributing cause to plaintiff's damages. The court held that the evidence was not sufficient to establish that the bridge materially obstructed the river's flow or that it caused or contributed to the flooding and resultant damage of plaintiff's land. The jury's verdict for defendant was affirmed. (Snow-Florida)
W71-00256

KANE V CITY OF NAUGATUCK (DAMAGES FROM FLOW OF SURFACE WATER).
120 Conn 548, 183 A 227-229 (1935).

Descriptors: *Connecticut, *Surface drainage, *Drainage water, *Roads, Drainage, Surface runoff, Runoff, Floods, Overland flow, Soil erosion, Judicial decisions, Damages, Highways, Flow, Natural flow, Legal aspects, Cities.

In an action for damages, plaintiff contended that defendant municipality had laid out and graded a highway which accumulated and discharged surface drainage water upon her premises, thus causing her property to be washed away. The court found from the evidence that the grading of the street did not throw any water upon plaintiff's property that would not have been discharged upon it by the natural surface flow. The court held that since defendant had done no act which contributed to plaintiff's damages, it could not be held responsible for such damages. (Snow-Florida)
W71-00266

ROGERS V BROWN (LICENSING OF CLAM CULTIVATION OPERATIONS).
190 A 632-634 (Me 1937).

Descriptors: *Maine, *Clams, *Commercial shellfish, *Permits, Aquatic animals, Judicial decisions, Legislation, Riparian land, Littoral, Shores, Riparian rights, Ownership of beds, Relative rights, Regulation, Shellfish, Coasts, Oceans, Administrative decisions, Administration.

In an action for mandamus, plaintiff sought to force municipal officers to grant him a license to plant and cultivate clams on the foreshores adjacent to the municipality. Plaintiff, a littoral property owner adjacent to such shores, contended that the legislative act authorizing municipal officers to exercise control over the planting and cultivating of clams directed such officials as a matter of course to grant a license to littoral proprietors. Defendant municipal officials contended that their power to grant licenses was discretionary and thus not subject to mandamus. The court held that the granting of licenses to plant and cultivate clams was a discretionary power and thus was not subject to the extraordinary writ of mandamus. (Snow-Florida)
W71-00278

EISENSTEIN V MAYOR, COUNSELOR AND ALDERMEN (CITY'S DRAINAGE SYSTEM MUST BE ADEQUATE TO ACCOMMODATE USUAL RAINFALL).
9 A2d 224-227 (Md 1939).

Descriptors: *Maryland, *Drainage systems, *Surface water, *Rainfall-runoff relationships, Precipitation excess, Rainfall intensity, Cities, Drainage, Floodwater, Diversion, Rain water, Sewers, Sewage disposal, Overflow, Basins, Floods, Flow augmentation, Judicial decisions, Legal aspects, Local governments, Cloudbursts, Relative rights, Repulsion (Legal aspects), Surface runoff.

Plaintiff's land was flooded and thereby damaged, allegedly as a result of a drainage system constructed and maintained by defendant city. Plaintiff sought to have defendant enjoined from maintaining the system in a manner that was inadequate to prevent his property from being flooded during heavy rains. Plaintiff did not allege negligence in the construction or maintenance of said system. The court ruled that defendant was not obligated to do more than take care of the usual and ordinary flow of water occasioned by rainfall or otherwise, and that infrequent and extraordinary occurrences which could not be foreseen and provided against created no obligation for defendant. Surface water is a common enemy and every proprietor must fight for himself so long as such water takes its natural course. Defendant could improve and repair streets without being liable for consequential damage caused by surface water to adjacent property. The trial court's judgment for defendant was affirmed. (Price-Florida)
W71-00279

STATE V RUVIDO (DEFINITION OF TERRITORIAL WATERS IN CRIMINAL PROSECUTION FOR VIOLATION OF TERRITORIAL LIMITS).
15 A2d 293-297 (Me 1940).

Descriptors: *Maine, *Boundary disputes, *Tidal waters, *State jurisdiction, Adjudication procedure, International law, Judicial decisions, Jurisdiction, Legal aspects, Legislation, Public rights, State governments, Water law, Water rights, Atlantic Ocean, Bays, Oceans, Coasts, Law of the sea, Shores, Islands, Continental margin, Commercial fishing, Seashores.
Identifiers: *Territorial waters.

Defendant commerical fisherman was convicted for a violation of a Maine statute prohibiting commercial fishing by non-residents in Maine's territorial waters between April 1st and November 1st. On appeal, defendant contended that he was fishing outside the state's territorial waters and that the statute was void for vagueness since it did not define territorial waters, nor did any other state statute. Affirming the conviction, the court adopted as a definition of territorial waters all waters within a marine league (three miles) from the coast, including bays not exceeding two marine leagues at their mouth. After extensive review of the geographical facts of the case, the court held that defendant was fishing within Maine's territorial limits. As to defendant's contention of vagueness, the court noted that the legislature could not exceed the territorial limits generally recognized by law, and held that the state's jurisdiction over territorial waters does not cease simply because the legislature has not defined them. (Liptak-Florida)
W71-00300

TOWARD AN EFFECTIVE AND CREDIBLE PROGRAM: WATER POLLUTION CONTROL,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
Leonard B. Dworsky.
Transactions of the American Geophysical Union, Vol 51, No 8, August 1970, p 600-606. 16 ref.

Descriptors: *Planning, *Programs, *Federal government, *Water pollution, *Water quality, Navigable waters, Governments, Water pollution-control, Water quality control, Water supply, Waste water treatment, Research and development, Sewage treatment, Technology, Management, Public health, Resource allocation, Priorities, Water policy.
Identifiers: *Public policy, *National water pollution control program, Policy, Technology assessment, Water quality management, Enforcement, Federal financial aid.

Marked changes are needed to produce an effective and credible national water pollution control program. Ten such changes are discussed: (1) federal jurisdiction over all navigable waters; (2) a national sewage and waste treatment policy; (3) a revision in the allocation of federal financial aid and the determination of project priorities; (4) regional water quality management programs as demonstration projects; (5) planning an effective national control program; (6) facilitating the use of advanced waste treatment technology; (7) improved enforcement of pollution control laws; (8) the consolidation of water supply and waste water service functions in local government; (9) research on better understanding the relationship between water pollution and public health; and (10) establishment of a program of technology assessment to assess consequences of man's actions. (Davis-Chicago)
W71-00311

SCANLON V IRON CITY SAND AND GRAVEL CO (LIABILITY FOR DREDGING OPERATIONS ABOVE THE LOW WATER MARK).

345 Pa 535, 29 A2d 82-84 (1942).

Descriptors: *Pennsylvania, *Dredging, *Boundary disputes, *Low water mark, Dams, Damages, Excavation, Rivers, Navigable rivers, Boundaries (Property), River beds, Banks, Riparian land, Islands, Judicial decisions, Water levels, Legal aspects, Water level fluctuations, Land tenure.

In an action to recover damages, plaintiff contended that defendant dredging company damaged his island property by removing sand and gravel above the ordinary low water line of the navigable river surrounding the island. Defendant contended that the ordinary low water line was no longer the boundary for measuring plaintiff's property. Instead, it was argued, the plaintiff owned only to a new mark, higher than the low water line, created by the raising of the level of the river by the construction of a dam by the federal government. Consequently, plaintiff did not own any land below the new mark and could not be harmed by defendant's operations. The court held that the raised water level by the construction of the dam did create a new line for determining the boundary of plaintiff's property. Therefore, the dredging did not interfere with plaintiff's possession, and defendant was not liable. (Snow-Florida)
W71-00314

CITY OF NEW BRUNSWICK V BOROUGH OF MILLTOWN (MUNICIPAL DISPOSAL OF WASTES).
135 NJ Eq 310, 38 A2d 288-290 (1944).

Descriptors: *New Jersey, *Municipal wastes, *Contracts, *Sewage disposal, Sewage, Path of pollutants, Wastes, Water pollution, Water pollution sources, Water pollution control, Domestic wastes, Pollutants, Sewage treatment, Waste disposal, Judicial decisions, Streams, Water supply, Relative rights, Cities, Local governments.

In an action to have a contract cancelled, plaintiff City of New Brunswick contended that it had exceeded its power in entering into the contract and that the contract was void as being against public policy since it imposed a perpetual obligation. Defendant contended that the contract, which provided that plaintiff would dispose of defendant's sewage providing that the defendant would not dispose of its sewage into a common creek which would lead to the pollution of plaintiff's water supply, was valid and that plaintiff could not be excused from its execution because it was more burdensome than contemplated. The court held that there was statutory authorization for plaintiff to have entered into the contract and that there was no prohibition of a contract of perpetual duration. The contract was therefore valid and enforceable. (Snow-Florida)
W71-00328

LOVEJOY V TOWN OF DARIEN (DESTRUCTION OF COASTAL OYSTER BEDS BY MUNICIPAL CONSTRUCTION OF SEWAGE PIPELINES).
131 Conn 533, 41 A2d 98-101 (1945).

Descriptors: *Connecticut, *Oysters, *Commercial shellfish, *Ownership of beds, Permits, Aquatic animals, Aquatic life, Shellfish, Beds, Beds under water, Judicial decisions, Navigable waters, Navigation, Oceans, Relative rights, Damages, Coasts, Sewage disposal, Pipelines, Pipes, Cities, Jurisdiction.

In an action for damages, the owner of a state franchise for the cultivation of oysters in coastal waters contended that defendant municipality had destroyed the usefulness of his oyster bed by the construction of a sewage pipeline into the coastal area where the bed was located. Defendant municipality contended that it was not liable under a theory that the general public is the absolute owner of land under navigable waters and that therefore a sovereign is not liable for any damage to an individual that results from its acts. The court held that a sovereign has paramount rights over navigable waters in dealing with rights of navigation, but that when navigational rights are not involved or are not interferred with, then any property taken for a public use must be justly compensated for. Thus defendant was liable for damages done to the oyster bed since the construction of the sewage pipeline was not related to defendant's rights of control over navigation. (Snow-Florida)
W71-00351

KANARKOWSKI V BOROUGH OF NORTH BRADDOCK (DUTY OF CITY TO PROPERLY DRAIN STREETS).
157 Pa Super 325, 43 A2d 381-383 (1945).

Descriptors: *Pennsylvania, *Ice, *Highway icing, *Cities, Surface waters, Damages, Judicial decisions, Streams, Drainage, Drainage water, Runoff, Standing waters, Surface drainage, Ponding, Surface runoff.

In an action for damages for personal injury, plaintiff contended that defendant municipality was negligent in allowing a creek to overflow from a clogged spillway onto a street which upon becoming icy caused plaintiff to fall. The court held that the municipality was under a duty to provide for proper drainage of water from its public streets and upon its failure to do so, as a proximate cause of plaintiff's injuries, was liable for negligence. Jury verdict for the plaintiff was affirmed. (Snow-Florida)
W71-00399

STRAUCH V CITY OF SCRANTON (DUTY OF MUNICIPALITIES TO PROVIDE DRAINAGE FOR SURFACE WATERS).
353 Pa 10, 44 A2d 258-261 (1945).

Descriptors: *Pennsylvania, *Highway icing, *Drainage, *Surface waters, Ice, Judicial decisions, Drainage water, Runoff, Standing waters, Surface drainage, Freezing, Highways, Governments, Local governments, Damages, Legal aspects, Surface runoff, Cities.

In an action to recover for injuries sustained from a fall on ice in a municipal roadway, plaintiff contended that defendant municipality had a duty to provide a drainage system adequate to prevent the forming of ice in the roadway from the accumulation of surface water naturally flowing upon such roadway. Defendant contended that its duty to keep its streets in a reasonably safe condition did not extend to the providing of drainage for the natural flow of surface water. The court held that there was a duty to provide a drainage system only in the exceptional case, whereas in the ordinary case the providing of a drainage system rested in the discretion of the municipality. The court held that the flow and discharge of surface water in this case was not of sufficient quantity and volume to place it within the exceptional case. The court ruled that defendant, being under no duty to provide a drainage system, was not liable for the injuries resulting from plaintiff's fall on the ice. (Snow-Florida)
W71-00401

HARRISON V GRANDISON CO (STATE OWNERSHIP OF BEDS UNDER NAVIGABLE WATERS).
51 F Supp 768-775 (ED La 1943).

Descriptors: *Louisiana, *Ownership of beds, *Navigable waters, *Boundary disputes, Land tenure, Land, Real property, Oil, Oil industry, Drilling, Oil fields, Oil wells, Drill holes, Exploration, Bayous, Beds, Geds under water, Boundaries (Property), Islands, Judicial decisions, Legal aspects.
Identifiers: *Servitude.

Plaintiff landowner brought suit to have defendant company's mineral servitude over his land declared extinguished by non-use. Plaintiff's grantor had reserved such interest and had later transferred the rights to defendant. A Louisiana statute required exercise of such rights within ten years or else they would be forfeited. Defendant had sunk two wells, one within the ten year period and the other on the day the period ended. The wells were sunk in different areas of plaintiff's land and plaintiff argued that certain bayous which traversed his property were navigable, thus giving the state ownership of the beds and separating his land into several parcels. If this were true, then only the area contiguous to the first well would remain subject to the servitude and the allegedly separate area surrounding the second well would be free from defendant's interest. The United States District Court, Eastern District of Louisiana, found that the bayous were not navigable, that plaintiff's land was all one tract and that defendant's entry onto one part of the land was sufficient to preserve the servitude over the entire area owned by plaintiff. (Barker-Florida)
W71-00419

TOWN OF DICKSON V STEPHENS (SPECIAL DAMAGE REQUIRED TO RECOVER FOR POLLUTION DAMAGE FROM MUNICIPALITY).

96 SW2d 201-212 (Tenn Ct App 1935).

Descriptors: *Septic tanks, *Tennessee, *Water pollution, *Sewage disposal, Municipal wastes, Judicial decisions, Legal aspects, Environmental sanitation, Construction, Waste treatment, Damages, Rivers, Cities, Local government, Adjudication procedure.

Plaintiff was the owner of a tract of farming and pasture land which had a river flowing through it. Plaintiff brought an action against defendant municipality for damages which resulted from the alleged pollution of the river by the drainage of sewage from a disposal plant constructed by defendant. The Court of Appeals of Tennessee affirmed a trial court decision for plaintiff and held that there was evidence of a depreciation in the rental value of plaintiff's farm which constituted special damages to plaintiff's property not likewise suffered by the public at large; therefore, the plaintiff did not lack standing as contended by the defendant. The court also held that evidence as to whether the condition of the stream at plaintiff's property was a nuisance at the time complained was for the jury to consider. Furthermore, the court held that evidence as to the character of the running stream above the landowner's premises and at the disposal plant was admissible in determining the condition of the stream at landowner's premises. (Powell-Florida)
W71-00425

KELLEY V CITY OF CAPE GIRARDEAU (CITY'S LIABILITY FOR SUCCESSIVE OCCURRENCES OF FLOOD DAMAGE CAUSED BY FAULTY STREET DRAINAGE).
89 SW2d 41-46 (Mo 1935).

Descriptors: *Missouri, *Drainage water, *Flood damage, *Adjudication procedure, Judicial decisions, Legal aspects, Water law, Compensation, Water injury, Damages, Remedies, Surface drainage, Roads, Drainage effects, Grading, Surface drainage, Rain water, Runoff, Cities, Local governments, Drains, Flooding, Storm drains.

Plaintiff landowner brought action against defendant city for damages resulting from flooding of plaintiff's property caused by the improper grading, curbing and guttering of defendant's streets. Plaintiff had already recovered damages in several previous actions for flooding on specific dates, but defendant failed to correct the improper drainage, and plaintiff sought to recover for damages occurring both prior to and after the previous actions. Defendant contended that plaintiff was barred from recovering for any damage which occurred prior to the previous actions, as those damages should have been sought in those actions. Reversing a judgment for plaintiff, the court held

that each occurrence of flood damage gave rise to a distinct right of action but that, in any one action, plaintiff should have sought all damages which had occurred up to that time. Therefore, in the present action, plaintiff was barred from recovering for those damages which had occurred prior to his last action against defendant, but could recover for any flood damage which had occurred since then. (Liptak-Florida)
W71-00426

MILLER LEVEE DIST NO 2 V WRIGHT (COMPENSATION FOR LAND DAMAGED VIA EMINENT DOMAIN TAKING).
111 SW2d 469-472 (Ark 1937).

Descriptors: *Arkansas, *Eminent domain, *Condemnation, *Compensation, Right-of-way, Drainage, Levees, Damages, Judicial decisions, Legal aspects, Drainage effects, Drainage water, Drainage districts, Condemnation value, Drainage practices, Drainage systems, Crop response, Property values.

Plaintiff landowner brought action to recover damages for injury to his property caused by a loop levee constructed by defendant. Plaintiff contended his recovery should include damages for all injury caused by reason of the levee. Defendant contended that plaintiff's rights of recovery and damages, if any, were limited to the actual value of the land taken, damages for resulting inconvenience, and damages to the remainder of the property caused by obstruction to the natural drainage. The court ruled that defendant's contention was contrary to statutory law and the state constitution. Where there is any invasion of private property by lawful authority for a public use and the property is damaged thereby, there is a taking within the meaning of the law, and where the damage is such as to deprive the owner of the beneficial use of his property, he may require that its value be paid him. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-00432

PETERSON V CITY OF ST JOSEPH (TITLE TO ACCRETION TO ISLAND).
156 SW2d 691-695 (Mo 1941).

Descriptors: *Accretion (Legal aspects), *Riparian land, *Islands, *Missouri, Missouri River, Navigable rivers, Riparian rights, Interstate rivers, Banks, Boundaries (Property), River beds, Land tenure, Real property, Local governments, Cities, Judicial decisions, Legal aspects, Riparian waters, Land forming, Erosion.

Plaintiff landowner brought action against defendant city to determine title to land formed by accretion in the Missouri River. Plaintiff contended that the land was formed by accretion to an island in the river and that he acquired title to the land under a patent from the county. Defendant contended that the land was formed by accretion to the shore and, as a riparian owner of the shore, the city was entitled to the land. Affirming a judgment for plaintiff, the court held that land which first forms in the river and later attaches to the land does not vest title in the riparian owner unless he also owns the river bed. Since the land first formed by accretion to the island, title was properly in the owner of the island. (Liptak-Florida)
W71-00439

HALE V KANSAS CITY, MO (CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY FAILURE TO OPEN FLOODGATE DURING RAINSTORM).
187 SW2d 31-41 (Mo Ct App 1945).

Descriptors: *Missouri, *Flood damage, *Storm drains, *Flood gates, Subsidence, Settlement (Structural), Runoff, Rain water, Water injury, Remedies, Judicial decisions, Legal aspects, Adjudication procedure, Sewers, Surface water, Local governments, Cities, Drains, Backwater, Pumping plants, Flood control, Cloudbursts, Compensation, Drainage systems.

Plaintiff paper bag company brought action against defendant city for flood damage to plaintiff's building caused by defendant's failure to open the sewer system's main floodgate during a heavy rainstorm. Plaintiff contended that no flooding would have occurred if defendant had opened the main storm drain and operated its drainage pumps. Defendant argued that submission of plaintiff's contention to the jury was improper since the purpose of the floodgate was not to facilitate the sewage system's flow, but to prevent water from the river from backing up into the sewer system during high water. Affirming a judgment for plaintiff, the court held that, regardless of the primary purpose of the floodgate, the jury properly heard and decided the question of whether defendant's failure to open the gate during the rainstorm was the proximate cause of the damage to plaintiff's building. (Liptak-Florida)
W71-00444

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 05G.
W71-00480

BENEFICIAL USE OF WATERSHEDS (IMPROVEMENT OF WATERSHED MANAGEMENT; NECESSITY FOR NEW WATER-ALLOCATION POLICY TO ACCOUNT FOR THE INCREASE IN RECREATIONAL USE).

American Water Works Association Journal, p 455-457 (1970).

Descriptors: *Watershed management, *Watershed Protect. and Flood Prev. Act, *Water allocation policy, *Water sports, Erosion control, Flood control, Surface runoff, Water management (Applied), Water supply, Watersheds (Basins), Small watersheds, Multiple-purpose projects, Preimpoundment, Water shortage, Water utilization, Recreation, Water conservation, Water pollution control, Irrigation programs, Municipal water, Sedimentation.

Two papers discuss the increased awareness of the importance of proper protection and management of watersheds. The first paper points out the rapid increase in recreational use of water supplies and the need to consider such use--in addition to the traditional uses for public supply, navigation, irrigation, and power generation--when planning water priorities, pollution control, and cost allocation. The second paper discusses the problem of small watersheds and the results of the Federal Watershed Protection and Flood Prevention Program which assists local communities in providing for flood prevention as well as the development of municipal, industrial, agricultural, and recreational water resources. (Liptak-Florida)
W71-00487

INDIANAPOLIS WATER CO V LUX (NECESSITY FOR CONDEMNATION OF PROPERTY FOR RESERVOIR).
64 NE2d 790-794 (Ind 1946).

Descriptors: *Indiana, *Condemnation, *Reservoirs, *Compensation, Eminent domain, Remedies, Damages, Dams, Backwater, Flooding, Flood damage, Water injury, Judicial decisions, Legal aspects, Adjudication procedure, Administrative decisions, Water supply, Water works, Public utilities, Real property.

Plaintiff water company brought action against defendant property owners to condemn their land for the construction of a dam and a reservoir. Plaintiff contended that some portions of defendants' land would be permanently flooded, some would be flooded at times of high water, and the remainder of the property was necessary for a border around the reservoir. Defendants argued that the land was not necessary for the proposed project. Reversing a judgment for defendants, the court noted that the question of necessity is usually left to the discretion of the condemning agency, but in a case where the contention is that there is no need at all, the courts will review such agency's decision. The court held that, although it usually does not weight the evidence, defendants had no evidence to dispute plaintiff's contentions or to justify the lower court's opinion. (Liptak-Florida)
W71-00488

NORTHERN STATES POWER CO V FEDERAL POWER COMM'N (REGULATORY POWER OF THE FEDERAL POWER COMMISSION).
118 F2d 141-144 (7th Cir 1941).

Descriptors: *Wisconsin, *Administrative agencies, *Public utilities, *Navigable waters, Judicial decisions, Legal aspects, Legislation, Federal government, Costs, Powerplants, Regulation, Permits, Hydroelectric power, Hydroelectric plants, Hydroelectric project licensing, Supervisory control (Power).
Identifiers: *Federal Water Power Act.

Petitioner utility company instituted proceedings to set aside a portion of an order by the Federal Power Commission directing petitioner to charge off certain items from its books in accord with the Commission's accounting requirements. Petitioner had applied with the Commission to have its utility project licensed in accord with the Federal Water Power Act. The court stated that the Act contemplates construction and operation of water power projects on navigable waters and government lands. Under certain circumstances, the government may take over projects, in which case the licensee receives reimbursement for its net investment. The Commission had ordered petitioner to charge certain items off because they did not represent a part of its net investment. Petitioner did not argue that these items were in its net investment, but questioned the right of the Commission to require it to strike these items from its account. There is no express authority in the Act empowering the Commission to require uniform accounting. The court found that the Commission's orders were a reasonable exercise of its power pursuant to the Act. These orders were not binding upon state utility agencies and did not constitute an unreasonable invasion in the field of management. (Duss-Florida)
W71-00489

HARPER V LEARNED (BOUNDARY DISPUTE OVER BATTURE LAND).

199 La 398, 6 So 2d 326-333 (1942).

Descriptors: *Louisiana, *Boundary disputes, *Accretion (Legal aspects), *Mississippi River, Boundaries (Property), Navigable rivers, Ownership of beds, Islands, Riparian rights, Lumbering, Riparian land, Riparian waters, Legal aspects, Judicial decisions, Adjudication procedure, Relative rights.

Plaintiff riparian landowner brought action against defendant riparian landowner to determine the mutual boundary between their respective batture lands and for damages for wrongful removal of timber. Plaintiff and defendant's predecessor in interest had agreed orally 40 years previously upon a visible boundary between their respective properties; defendant purchased his land in reliance upon that boundary. The court held that plaintiff was estopped from maintaining that the boundary previously agreed upon was not the proper boundary as between himself and defendant. The court stated that the batture lands were granted to the riparian owner by law, observing that parol evidence was admissible to prove a visible bounda-

ry recognized by the parties. Plaintiff's suit was dismissed by the court. (Hart-Florida)
W71-00490

LOSSING V SHULL (ONE WHO ACQUIRES TITLE TO MAIN LAND BY ADVERSE POSSESSION ACQUIRES TITLE TO ACCRETED LAND).
173 SW2d 1-8 (Mo 1943).

Descriptors: *Missouri, *Accretion (Legal aspects), *Prescriptive rights, *Patents, Judicial decisions, Legal aspects, Rivers, Mississippi River, Boundaries (Property), Bank erosion, Water rights, Riparian rights, Riparian land, Banks, Remedies, Riparian waters, Prior appropriation.
Identifiers: *Adverse possession.

An 1860 patent granted a portion of the west high bank of the Mississippi River to plaintiff's predecessors in title. The patent failed to expressly name the state and county wherein the land was located. Five acres of land were added to this grant through accretion. In 1932, defendant's predecessor in title docked his houseboat on the accreted tract, assumed possession, and subsequently, conveyed the accreted land to defendant. Plaintiff brought an action to quiet title and an action in ejectment for the accreted land. Defendant contended that plaintiff, having failed to establish title by deed in any land at the river's edge because of the defective patent, could not maintain an ejectment action for accreted land. Defendant further contended that, if plaintiff acquired the granted land by adverse possession, title was not acquired so that accretion would attach to such lands. The Supreme Court of Missouri, in affirming a judgment for plaintiff, held that the defective patent was sufficient to pass title. Furthermore, accretion becomes a part of the land to which it is built, and follows whatever title covers the main land, whether it be title by deed or by adverse possession. (Powell-Florida)
W71-00491

GERLACH LIVESTOCK CO V THE UNITED STATES (RIPARIAN RIGHTS ARE PROPERTY RIGHTS NOT TO BE TAKEN WITHOUT JUST COMPENSATION).

102 Ct Cl 392-399 (1944).

Descriptors: *California, *Condemnation, *Riparian rights, *Compensation, Diversion losses, Eminent domain, Irrigation, Navigable waters, Navigation, Relative rights, Public rights, Federal government, Flood control, Legislation, Land reclamation, Dams, Riparian land, Riparian waters, Judicial decisions, Legal aspects, Alteration of flow, Diversion dams.

Plaintiff landowner sought to recover the value of his water rights allegedly lost by the construction of a dam by defendant United States. Plaintiff contended defendant's action was a taking of private property as contemplated by the fifth amendment. Defendant contended that plaintiff's petition failed to allege a taking of its property or property rights within the meaning of said amendment, and that any damage was indirect, consequential, and not within the jurisdiction of the court. The court ruled that a landowner's rights in a navigable stream are subject to the paramount right of the government to take whatever steps it deems necessary in the improvement of navigation, but the government has no such right in the water of a stream for irrigation purposes. Plaintiffis riparian rights in the stream, if any, were property rights, of which he could not be deprived without being paid just compensation. Defendant's demurrer was overruled. (Price-Florida)
W71-00492

PITT RIVER POWER CO V UNITED STATES (RIGHT TO COMPENSATION FOR CONDEMNATION ACCRUES ONLY AFTER ACTUAL LOSS OCCURS).
98 Ct Cl 253-256 (1942).

Descriptors: *California, *Flood damage, *Riparian rights, *Land reclamation, Judicial decisions, Legal aspects, Flood protection, Flooding, Flood control, Eminent domain, Condemnation, Federal government, Dams, Legislation, Canals, Reservoirs, Adjudication procedure, Compensation, Water injury.

Plaintiff landowner sought damages under a condemnation theory for flooded lands, for lands that would not be flooded but would be damaged due to flooding, and for the loss of riparian rights that he contended would result from defendant United States' construction of dams and reservoirs near his property. Defendant contended that plaintiff had failed to state a cause of action as the dams were not completed, no flooding had taken place, and plaintiff had not sustained any loss. The court, held that no cause of action had been stated since no loss had come to plaintiff and no loss might ever come as the project might never be completed. The granting of defendant's demurrer was sustained. (Price-Florida)
W71-00493

THE OYSTER CASES (DAMAGE TO OYSTER BEDS CAUSED BY DREDGING OPERATIONS).
94 Ct Cl 397-441 (1941).

Descriptors: *United States, *Oysters, *Dredging, *Damages, Federal jurisdiction, Channel improvement, Bottom sediments, Ownership of bed, Legislation, Beds, Silting, Channels, Harbors, Coastal engineering, Legal aspects, Navigation, Compensation, Adjudication procedure, Leases, Commercial shellfish, Federal government.

Plaintiffs claimed that their oyster beds had been damaged by dredging operations of the United States. A suction dredge used to improve the New Haven harbor channel threw up large quantities of mud and silt, covering the oyster beds and killing the oysters. Shovel-type dredges had previously been used with little damage to beds. The court found that the failure of the United States to give notice, until shortly before the operation began, that the suction dredge would be used constituted failure to use due care in the protection of plaintiffs' property. In all instances, the court found that the exact amount of damage was impossible to determine. Also, despite the short notice, the court held that plaintiffs could have mitigated damages to some extent by moving as many oysters as possible out of the affected area beforehand. In each instance, plaintiffs recovered the court's estimate of non-mitigable damages. (Caldwell-Florida)
W71-00494

KIRCH V UNITED STATES (CONDEMNATION OF RIPARIAN LAND BY FAILURE TO MAINTAIN LEVEE).
91 Ct Cl 196-203 (1940).

Descriptors: *Louisiana, *Compensation, *Levees, *Condemnation, Mississippi River, Flood protection, Eminent domain, Shore protection, Flooding, Flood damage, Soaking, Water injury, Federal government, United States, Federal project policy, Administrative agencies, Depreciation, Judicial decisions, Legal aspects, Erosion.

Plaintiff riparian landowner sought to recover damages under the fifth amendment of the Constitution from defendant United States for a taking of his property. Plaintiff's land extended to a levee on the Mississippi River. Because of continued erosion by the river, defendant erected a second levee further back from the river, leaving the original levee and plaintiff's land between the levees to be flooded and eroded. Plaintiff contended that this action constituted a taking under the fifth amendment. The court initially noted that erection of the set-back levee did not cause the river to flood plaintiff's land, and that flood control legislation did not assume responsibility for consequential damages. The court stated that defendant had no duty to erect and maintain levees to protect riparian owners, and hence was under no duty to respond in damages. Loss of market value was found by the court not to constitute a fifth amendment taking. The court concluded that there had been no taking within the fifth amendment, and dismissed plaintiff's petition. (Hart-Florida)
W71-00495

MATTHEWS V UNITED STATES (LIABILITY FOR CONSEQUENTIAL FLOODING CAUSED BY FLOOD CONTROL PROJECT).
87 Ct Cl 662-721 (1938).

Descriptors: *United States, *Flood control, *Condemnation, *Compensation, Easements, Flood damage, Legislation, Levees, Floodways, Damages, Land use, Legal aspects, Floods, Flood plains, River basins, Backwater, Surface drainage, Rivers, Flooding, Historic flood, Water levels, Overflow, Blowouts, Mississippi River.

Plaintiff sought compensation for an alleged taking of his land. He claimed that the construction of a flood control project along the Mississippi River would result in backwater being diverted onto his forestland whenever the river reached a certain level. While the evidence supported plaintiff's contention, it was also brought out that the property had always been subject to flooding when the river reached that level. The court held that to constitute a compensable taking, the overflow had to be the direct result of and wholly attributable to the government project, and constitute an actual and permanent invasion of the land. Because the alleged flooding was held to be merely a temporary condition, and because the project was not the sole cause of the flooding, any damage which the plaintiff had suffered was held to be merely consequential injury. Such injury was held non-compensable, and recovery was denied. (Caldwell-Florida)
W71-00496

MARRET V UNITED STATES (LIABILITY FOR DAMAGES CAUSED BY RAISING WATER LEVEL OF RIVER).
82 Ct Cl 1-14 (1935).

Descriptors: *Kentucky, *Dams, *Eminent domain, *Water levels, Ownership of beds, Navigable rivers, Navigation, Riparian land, Riparian rights, Riparian waters, Federal Power Act, High water mark, Low water mark, Condemnation, Damages, Water injury, Flooding, Flood damage, Buildings, Judicial decisions, Legal aspects, Water level fluctuation, United States.

Plaintiff landowner brought action against defendant United States for inverse condemnation. Plaintiff owned riparian land located on a river. He erected a resort hotel in the river bed, designing it so that periodic high water would flow through the lower floor. Defendant United States raised its dam level two feet, causing a permanent increase in the river level and flooding the lower part of the hotel. Consequently, the hotel structure began to settle and crack. Plaintiff contended that his property was taken without just compensation. The court noted the marked distinction between a taking and mere resulting damage, and held that defendant was not liable for plaintiff's damages. The court found that a riparian owner's title to the bed below high water mark was subservient to the paramount power of defendant to improve navigation. Concluding that plaintiff was merely damaged by rightful government action, the court dismissed plaintiff's petition. (Hart-Florida)
W71-00497

L J HOUZE CONVEX GLASS CO V UNITED STATES (WATER DAMAGE TO GAS WELL).
81 Ct Cl 661-670 (1935).

Descriptors: *New York, *Dams, *Navigable rivers, *Wells, Natural gas, Design flood, Ponding, Eminent domain, Condemnation, Condemnation value, Navigation, Flooding, Inflow, Soaking, Submergence, Wetting, Flood damage, Judicial decisions, Legal aspects, Overflow, Dam design, United States.

Plaintiff glass company sued defendant United States for damages to plaintiff's gas well. Defendant raised the height of its dam, which made the earth around plaintiff's well wet and infirm. Two subsequent floods caused water to overflow into plaintiff's well, stopping gas production. Plaintiff contended that raising the dam height caused the well to overflow; defendant claimed the subsequent floods were the direct cause of plaintiff's injury. The court noted that defendant had the power to construct a dam in aid of navigation, and that defendant could be liable for property taken as a direct result. However, the court found that defendant was not liable for consequences not directly attributable to the dam, and since the floods caused plaintiff's injury, the court dismissed plaintiff's petition. (Hart-Florida)
W71-00498

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
80 Ct Cl 367-375 (1934).

Descriptors: *West Virginia, *Flooding, *Dams, *Compensation, Eminent domain, Condemnation value, Condemnation, Flood damage, Design flood, Damages, Judicial decisions, Legal aspects, Submergence, Ponding, Navigation, Dam design.

Plaintiff landowner sued defendant United States for damages for inverse condemnation of plaintiff's land by defendant. Defendant increased the height of its dam, which caused inundation of plaintiff's land, rendering plaintiff's route of ingress and egress impassable. The court held that defendant's actions constituted a taking for public use, and that plaintiff was entitled to just compensation therefor. (Hart-Florida)
W71-00499

PEOPLE EX REL NEW YORK CENT RR V STATE TAX COMM'N (NAVIGABILITY OF RIVER DETERMINES TAX ASSESSMENT).
268 App Div 805, 48 NYS2d 570-571 (1944).

Descriptors: *New York, *Navigable rivers, *Bridges, *Assessments, Taxes, Navigable waters, Rivers, Streams, Administrative agencies, State governments, Judicial decisions, Legal aspects, Administrative decisions, Railroads.

Plaintiff railroad company brought action to review a tax assessment of defendant Tax Commission. Defendant had assessed plaintiff's bridge as a special franchise. The navigability of the river at the bridge determined whether the bridge was a special franchise. The court noted that the legislature had twice declared the river a public highway for transportation of logs and other property, and found that the lower court had improperly tested navigability by whether the bridge interfered with use of the river as a public highway. Holding that the river was navigable and that the assessment was proper, the court reversed the lower court's decision for plaintiff. (Hart-Florida)
W71-00500

NIAGARA FALLS POWER CO V MALTBIE (CONTROL OF HYDROELECTRIC POWER RATES).
41 NYS2d 424-432 (1943).

Descriptors: *New York, *Navigable rivers, *Hydroelectric power, *Federal Power Act, Hydroelectric plants, Hydroelectric project licensing, Dams, Administrative agencies, Electric power rates, State governments, Water allocation (Policy), Administrative decisions, Judicial decisions, Legal aspects, Federal government.

Plaintiff hydroelectric company brought action against defendant public service commission to review a rate order promulgated by defendant. Plaintiff's dam was on the Niagara River. Requirements for additional war production caused the Federal Power Commission to allow plaintiff to divert more water, but the Commission required that an amount equal to the additional profits generated thereby at the present rate be placed in a reserve fund. However, defendant also reduced the rate which plaintiff could charge commensurately with the profit from the additional diversion. Hence, if plaintiff complied with the orders of both commissions, it would operate at a substantial loss. The court noted that since the river was navigable, Congress had power to regulate use of the water. Furthermore, the court found that the Commission had no authority under the Federal Power Act to fix rates, that authority being reserved to defendant. Therefore, the court held that defendant's rate was proper, and since no profit would be created at the lowered rate, no payments would accrue to the reserve fund. (Hart-Florida)
W71-00501

PEOPLE EX REL NEW YORK CENTRAL RR V STATE TAX COMM'N (NAVIGABILITY CRITERIA IN DETERMINING TAXABILITY OF BRIDGE).
258 App Div 356, 16 NYS2d 812-819 (1940).

Descriptors: *New York, *Taxes, *Navigable waters, *Bridges, Railroads, Ownership of beds, Rivers, Non-navigable waters, Riparian rights, Public rights, Easements, Legal aspects, Judicial decisions, Bays, Structures, Bridge design, Beds under water, Boats, Transportation, Legislation, Administrative agencies.

Plaintiff railroad sought to have a special franchise tax, which defendant State Tax Commission had levied on several of its bridges, annulled. The tax was applicable only to bridges crossing navigable waters for a distance of more than 250 feet. The railroad contended that although the total length of each bridge exceeded 250 feet, only that portion of the river beneath the bridges' high center span was in fact navigable, and that it was this shorter length which should be used in determining the applicability of the statute. The court rejected this contention, holding that the historic test for navigability was whether the waterbody could be used for waterborne commerce. If this test was met, the entire river was to be considered navigable, not just the portion actually used by the commercial transportation. The imposition of the franchise tax was upheld by the court, which held that the entire width of a navigable stream was to be considered in determining whether the 250 foot criteria was met. (Caldwell-Florida)
W71-00502

PEOPLE V REILLY (RIGHT TO REGULATE ACTIVITIES OVER OWNED BEDS).
14 NYS2d 589-595 (1939).

Descriptors: *New York, *Boating regulations, *State jurisdiction, *Coasts, Administrative agencies, Boats, Supervisory control (Power), Regulation, Legal aspects, Judicial decisions, Ownership of beds, Beaches, Navigable waters, Atlantic Ocean, Recreation, Navigation, Relative rights, Public rights, Condemnation, Beds under water, Local governments.

Defendant was accused of violating the city's regulations forbidding advertising or boating within 1000 feet of the Coney Island Beach. He challenged the city's jurisdiction over him on the grounds that the city's boundary ran only to the low water mark of the ocean. He contended that any regulation covering areas beyond the city boundary would therefore be invalid. However, the city had previously acquired through condemnation the ocean beds extending out 1000 feet into the Atlantic Ocean. The court held that in the absence of express statutory limitations, the boundaries of the city extended to the farthest point of the territory owned by it. As the defendant's actions took place in the ocean less than 1000 feet offshore, the city was held to have jurisdiction. The court found the regulations to be reasonable, and the defendant was found guilty of violating them. (Caldwell-Florida)
W71-00503

WOOD V MAITLAND (DISPUTE OVER TITLE TO LAKESHORE AND MARSH).
169 Misc 484, 8 NYS2d 146-157 (1938).

Descriptors: *New York, *Boundaries (Property), *Lakes, *Boundary disputes, Water levels, Water level fluctuations, Shores, Legal aspects, Marshes, Land tenure, Relative rights, Judicial decisions, Navigable waters, Inland waterways, Outlets, Ponds, Lake Ontario, Low water mark, State governments.

Plaintiff sought to assert title to property along Lake Ontario down to the existing shoreline. Defendant state claimed that the original grant to plaintiff's predecessor in title, reflecting a boundary 'along the lake', fixed the boundary of the property at the shoreline as of the date of the grant. The water level having fallen since the grant, the state claimed ownership of the additional exposed land. The court rejected this claim, holding that the proper boundary was the variable low water mark of the lake and that plaintiff therefore owned the additional land. Plaintiff similarly asserted his claim to a pond and marsh on his property near Lake Ontario, defendant claiming that they were really a part of the lake belonging to the state. The court found that as the pond level was higher than that of the lake, it was not and never had been part of the lake. The state could assert no title in it. (Caldwell-Florida)
W71-00504

JOHN B KELLY, INC V LEHIGH NAV COAL CO (POLLUTION OF RIVER BY COAL MINING INDUSTRY).
151 F2d 743-749 (3d Cir 1945).

Descriptors: *Pennsylvania, *Water pollution, *Coal mine wastes, *River beds, Flooding, Coal mines, Water pollution sources, Water injury, Damages, Hydraulic mining, Pollutants, Water pollution effects, Federal jurisdiction, Judicial decisions, Legal aspects, Adjudication procedure, Industrial wastes.

Plaintiff riparian landowner sought damages and a restraining injunction against defendant coal mining companies for discharge of mining wastes into a river. Plaintiff contended that discharge of the wastes polluted the river, raised the river bed at plaintiff's land, interfered with plaintiff's business, and constituted a continuing trespass on plaintiff's land. Defendants contended that plaintiff failed to allege damages in the jurisdictional amount and that plaintiff's damages were not special, but in common with the public at large. The court found that liability of the companies was several rather than joint, but concluded that damages were merely collateral to the injunction sought, and therefore jurisdiction might properly be assumed over the issue of damages. Furthermore, the court found that plaintiff had sufficiently asserted special damages by alleging that the waste was settling upon his land and raising the water level over plaintiff's land. Plaintiff's complaint was held to state a cause of action. (Hart-Florida)
W71-00505

UNITED STATES V BELT (TITLE DISPUTE OVER RIPARIAN LAND).
142 F2d 761-67 (DC Cir 1944).

Descriptors: *District of Columbia, *Navigable rivers, *Riparian rights, *Boundary disputes, Navigation, Riparian land, Riparian waters, Highways, Federal government, Administrative agencies, United States, Reservation doctrine, Ju-

dicial decisions, Legal aspects, Boundaries (Property), United States, Land tenure, Real property.
Identifiers: *Title disputes.

Plaintiff United States brought action to quiet title to riparian land claimed by defendant landowner. Defendant owned land lying between a road and a river; such land was conveyed to defendant's predecessor in interest by United States commissioners in consideration for other lands. Plaintiff contended that the commissioners had only conveyed a water privilege to defendant's predecessor. The court noted that riparian rights include access for navigation and the right to erect wharves, subject to sovereign regulation, and found that while riparian rights were qualified by the rights of the public, they could not be arbitrarily impaired. The previous conveyance by the commissioners to defendant's predecessors in title was held to be in fee simple, with full riparian rights adhering thereto, and the lower court's decision for defendant was affirmed. (Hart-Florida)
W71-00506

BANKLINE OIL CO V COMMISSIONER OF INTERNAL REVENUE (INCOME TO TENANT DERIVED FROM LEASE OF TIDELANDS FROM STATE IS TAXABLE).

90 F2d 899-906 (9th Cir 1937).

Descriptors: *California, *Legislation, *Taxes, *Ownership of beds, Mineralogy, Permits, Rent, Mineral industry, Judicial decisions, Legal aspects, Public benefits, Public rights, Navigation, Relative rights, Leases, Administrative agencies, Administrative decisions.

In a petition for the review of decisins of the United States Board of Tax Appeals, petitioner sought exemption during the taxable year 1930 of all income derived from tidelands leased from the State of California for the purpose of producing oil and gas therefrom. The court stated that the State of California holds the tidelands within its boundaries in trust for the people so that they may enjoy the navigation of the waters, carry on commerce, and have the liberty of fishing therein free from interference of private parties. Petitioner's lease was granted pursuant to state statute, and the state supreme court had upheld such legislation against claims that it violated said trust. The income tax was not levied on the land so held in trust, nor the income of the state derived therefrom. The tenant obtaining such a lease for his own profit is subject to taxation, even if such liability reduces the amount received by the state as consideration for the lease. The Board's decision was affirmed as to petitioner's tax liability for income derived from the tidelands. (Price-Florida)
W71-00507

HEWITT V PERRY (ENJOINING OF INTERFERENCE WITH RECREATION EASEMENT).
34 NE2d 489-492 (Mass 1941).

Descriptors: *Massachusetts, *Bulkheads, *Easements, *Beaches, Beach erosion, Tidal effects, Shore protection, High water mark, Low water mark, Recreation, Swimming, Fishing, Boating, Retaining walls, Judicial decisions, Legal aspects, Relative rights, Remedies, Access routes.

Plaintiff easement holder sought to enjoin defendant riparian landowner from erecting a bulkhead which would interfere with plaintiff's easement. Plaintiff owned an easement appurtenant across defendant's beach for swimming, boating, fishing and recreation; plaintiff operated a boat rental business pursuant to the easement. Defendant had erected a bulkhead along the beach, and planned to extend it. Plaintiff asserted that the bulkhead interfered with his easement, and defendant counterclaimed that plaintiff's boat rental business surcharged the easement. The court noted that a beach is primarily the area between high and low water marks, but that in this instance the word had assumed a secondary meaning as land above the high water mark. The court held that defendant's ownership of the beach provided no right to interfere with plaintiff's easement, and ordered removal of the bulkhead. As to defendant's counterclaim, the court found that plaintiff's easement did not include operating a commercial boat-letting business, and enjoined plaintiff from its operation. (Hart-Florida)
W71-00508

STATE EX REL DUFFY V LAKEFRONT EAST FIFTY-FIFTH ST CORP (TITLE DISPUTE IN LITTORAL RELICTION).
137 Ohio St 8, 27 NE2d 485-487 (1940).

Descriptors: *Ohio, *Lake Erie, *Accretions (Legal aspects), *Boundary disputes, Boundaries (Property), Landfills, Land forming, Lakes, Lake beds, Bulkheads, State governments, Lake shores, Navigation, State jurisdiction, Reservation doctrine, Judicial decisions, Legal aspects, Littoral, Leases, Real property.
Identifiers: *Title disputes.

Plaintiff state brought action to evict defendant littoral leaseholder from a reliction on Lake Erie. The reliction was formed when the contiguous owners artificially filled their landfronts, forming a pocket in front of defendant's leasehold which facilitated natural accretion. Defendant contended ownership of the reliction by common law, while plaintiff asserted that since the reliction was formed artificially, defendant had no rights in it. The court first found that various statutes did not affect the common law, and stated that if the accretion was formed naturally, defendant had an estate therein. Artificial filling by contiguous littoral owners was found not to alter defendant's riparian rights. Finding that any artificial filling which may have occurred in the disputed reliction was trivial, the court held that the reliction was formed naturally, and that defendant held title thereto. (Hart-Florida)
W71-00509

IRIS V TOWN OF HINGHAM (DIVISION OF FLATS ADJACENT TO RIPARIAN LAND).

22 NE2d 13-17 (Mass 1939).

Descriptors: *Massachusetts, *Boundary disputes, *Accretions (Legal aspects), *Harbors, High water mark, Low water mark, Boundaries (Property), Riparian rights, Riparian land, Riparian waters, Navigable waters, Cities, Condemnation, Parks, Eminent domain, Ownership of beds, Remedies, Judicial decisions, Legal aspects.

Plaintiff riparian landowner brought action to recover damages for property taken by defendant city for a public park. Plaintiff asserted ownership of certain mud flats in a harbor. A colonial ordinance specified that an upland owner's title extended to the low water mark or 100 rods from the high water mark, whichever was the lesser. The court stated that an upland owner was entitled to an equitable portion of adjacent flats, considering in determining the portion of such ownership: (1) the width of upland; (2) the shape of shoreline; (3) the distance between high and low water marks; (4) the contours of the high water mark relative to the low water mark; (5) the length of high and low water marks; and (6) the total area of the flats. The general rule for determination of the division of flats was stated by the court as: (1) where the shoreline is relatively straight, the sidelines of the upland lots comprise the sidelines of the flats; (2) where the shoreline is concave, the sidelines of the flats are convergent; and (3) where the shoreline is convex, the sidelines are divergent. However the court held that when, as in the instant case, the characteristics of the site are unusual, the general rule is inapplicable, and equitable considerations will be used to determine the flat boundaries. (Hart-Florida)
W71-00510

CITY OF NEW YORK V THIRD AVE RY (LANDFILL AND BUILDINGS AS INCLUDED IN RIPARIAN RIGHT OF ACCESS).
294 NY 238, 62 NE2d 52-55 (1945).

Descriptors: *Riparian rights, *River beds, *New York, *Landfills, Usufructuary right, Docks, Railroads, Navigable rivers, Ownership of beds, Riparian land, Riparian waters, Legal aspects, Judicial decisions, Land tenure, Bulkhead line, Coastal structures, Access routes, Right-of-way, Public rights, Cities, Navigation, Transportation.

Plaintiff city brought an action against defendant railway company to recover possession of city property which defendant had filled in adjacent to its riparian land and to recover damages for the use of the land. Plaintiff contended that defendant's filling in of the river bottom and erection of several buildings thereon exceeded its riparian right to 'wharf out' as a means of access to deep water. Defendant argued that its buildings were related to the loading and unloading of freight and were therefore within the scope of its riparian right of access. Affirming a judgment for defendant, the court held that, although the wharfing right is subject to the superior right of the public, defendant's use of the property was reasonable as it was directly related to its freight operations, and there was no interference with any known or contemplated public use. (Liptak-Florida)
W71-00511

GOODWIN V TEXAS CO (LIABILITY FOR DAMAGES FOR SEEPAGE OF COLLECTED WATER AND OBSTRUCTION OF WATERCOURSE).
176 A 873-874 (Me 1935).

Descriptors: *Maine, *Watercourses (Legal), *Obstruction to flow, *Seepage, Diversion, Discharge (Water), Land tenure, Damages, Legal aspects, Judicial decisions, Easements, Flow, Channels, Banks, Beds, Streams, Flood damage, Overflow, Drainage, Relative rights, Dams, Landfills, Freshwater, Saline water, Maps.

Plaintiff landowners brought suit against defendant company for damages which resulted from the flooding of plaintiffs' lands. Defendant had made a landfill with dredgings, and sea water seeped through, overflowing plaintiffs' lands. Defendant had also obstructed a natural watercourse which drained plaintiffs' lands, resulting in more flooding. General verdicts were returned for plaintiffs and defendant appealed. The Supreme Judicial Court of Maine affirmed. Regarding the seepage of seawater from the fill, it is a settled rule that no one may artificially collect water on his land and discharge it unlawfully on his neighbor's property. As to the obstruction of the natural watercourse, it is settled that there is a public or natural easement in a watercourse belonging to all persons whose lands are benefited. It is unlawful to obstruct such watercourse or to divert it to the injury of other proprietors. Evidence supported a finding that defendant had obstructed a watercourse to plaintiffs' injury. (Duss-Florida)
W71-00512

STURTEVANT V FORD (UPSTREAM OWNER LIMITED TO REASONABLE USE OF WATER).
182 NE 560-567 (Mass 1932).

Descriptors: *Massachusetts, *Riparian rights, *Reasonable use, *Mill dams, Relative rights, Natural flow doctrine, Alteration of flow, Dams, Damsites, Obstruction to flow, Streams, Usufructuary right, Damages, Remedies, Flow rates, Fluctuation, Velocity, Water utilization, Water storage, Ponding, Water rights, Judicial decisions, Legal aspects.

In a suit for injunction and damages, plaintiff riparian landowner claimed that defendant upstream owner had unreasonably interfered with his riparian rights in a stream which flowed through both properties. Defendant had constructed and main-

tained small dams designed to produce power to operate mills on his property. However, no mill was erected at one of the dams and plaintiff argued that such storage of water for no reasonable purpose interfered with his riparian rights in that the flow of the stream was greatly diminished thereby. The Supreme Judicial Court of Massachusetts ruled that an upper riparian owner may make reasonable use of water and not be held liable for damages resulting from such reasonable use. The court affirmed the lower court's decision that the storage of water by defendant was unreasonable since no mill was operated thereby. The injunction granted below was upheld as to the one non-functioning dam but the assessment of damages was reversed for further consideration of the proper measurement of such damages. (Barker-Florida)
W71-00513

TICHENOR V HARBISON (DISCHARGE OF OIL WELL OVERFLOW INTO NATURAL WATERCOURSES).
166 NE 927 (Ind Ct App 1929).

Descriptors: *Indiana, *Damages, *Oil wells, *Oil wastes, Riparian rights, Relative rights, Remedies, Judicial decisions, Adjudication procedure, Legal aspects, Brine disposal, Wells, Water pollution sources, Water pollution effects, Groundwater, Wastes, Oily water, Oil, Oil industry, Industrial wastes, Brines, Riparian land, Natural streams, Land.

In an action by plaintiff landowners, seeking a restraining order and damages for the alleged wrongful discharge, into a natural watercourse, by overflows of mineral and salt waters from defendants' oil wells onto the lands of plaintiffs, defendants' demurrer was overruled. The cause was tried by a court without a jury and damages were awarded. Defendants' motion for a new trial was denied. The Appellate Court of Indiana affirmed on the authority of the case of Tichenor v Witherspoon, 87 Ind App 79, 158 NE 514. (Dye-Florida)
W71-00514

SMITH V BAY STATE DREDGING AND CONTRACTING CO (NEGLIGENT POLLUTION OF WATER BY DREDGING UNDER GARBAGE DISPOSAL WHARF).
172 NE 67-68 (Mass 1930).

Descriptors: *Massachusetts, *Docks, *Lobsters, *Water pollution, Watercourses (Legal), Developed waters, Sewage disposal, Garbage dumps, Dredging, Water rights, Judicial decisions, Legal aspects, Waste dumps, Waste disposal, Domestic wastes, Municipal wastes, Damages, Water pollution effects.

Plaintiff stored his lobsters in cars floating at his wharf in Boston. An adjacent wharf was a station for the disposal of garbage. Defendant independent contractor was hired to remove the accumulation of refuse matter under the disposal wharf. In performing his work, defendant polluted the surrounding water and weakened or killed many of plaintiff's lobsters. Plaintiff brought an action for damages to his lobsters caused by defendant's scraping of refuse matter under the garbage disposal wharf. The Supreme Judicial Court of Massachusetts sustained plaintiff's exceptions to the lower court's directed verdict for defendant. The court held that the negligence of defendant, polluting water by dredging under the disposal wharf, and the damaging of plaintiff's lobsters which were in cars in plain sight were proper considerations for the jury. (Powell-Florida)
W71-00515

MCGOWEN V CARR (RIGHT TO UNOBSTRUCTED FLOW OF WATER IN NATURAL WATERCOURSE).
272 Mass 573, 172 NE 787-788 (1930).

Descriptors: *Massachusetts, *Watercourses (Legal), *Ditches, *Obstruction to flow, Artificial watercourses, Channels, Conduits, Drainage, Drains, Water conveyance, Drainage systems, Drainage waters, Outlets, Flow, Watersheds (Basins), Natural flow, Springs, Spring waters, Judicial decisions, Relative rights, Channel flow.

Plaintiff brought an action to restrain defendant from obstructing the drainage flow of water across his land. Plaintiff contended that a ditch system, which transversed the parties' adjoining lands, was a natural watercourse and as such defendant had no right to obstruct the flow of the water in the ditch and cause it to back up upon plaintiff's land. Defendant contended that the ditch system was an artificial one designed to carry surface drainage and as such he was not prohibited from obstructing the ditch upon his property. The court found that the ditch system was a natural watercourse in that it carried off the overflow of various springs above the properties and did not merely carry off surface drainage. The plaintiff, having the right to a free flow of the water of a natural watercourse, was thus entitled to restrain defendant from obstructing such flow. (Snow-Florida)
W71-00516

HEINSE V THORBORG (DIVERSION OF NATURAL FLOW).
230 NW 881-882 (Iowa 1930).

Descriptors: *Iowa, *Obstruction to flow, *Natural flow, *Relative rights, Natural flow doctrine, Depression, Watercourses (Legal), Diversion, Diversion structures, Remedies, Judicial decisions, Legal aspects, Banks, Easements, Overlying proprietors, Surface waters, Surface runoff, Surface drainage.
Identifiers: *Swales.

Plaintiff landowner brought an action in equity to enjoin defendant neighboring landowner from allegedly diverting water onto plaintiff's land. Plaintiff claimed that the natural course of certain surface water was through defendant's land and that defendant had wrongfully diverted the water onto his land. Defendant argued that the natural course was through plaintiff's land and sought to prohibit plaintiff from obstructing such natural flow. The Supreme Court of Iowa found that the natural course was through plaintiff's land, thus making that property the subservient estate of defendant's dominant estate. The court further fuled that the subservient owner was under a duty not to obstruct the natural flow of water from the dominant estate. The trial court's ruling for defendant was affirmed. (Barker-Florida)
W71-00517

KYSER V NEW YORK CENT RR (RIPARIAN RIGHT TO MAKE REASONABLE USE OF RIVER'S WATERS).

151 Misc 226, 271 NYS 182-187 (1934).

Descriptors: *New York, *Water utilization, *Reasonable use, *Riparian rights, Competing uses, Consumptive use, Non-consumptive use, Diversion, Water pollution, Disposal, Impaired water quality, Pollutants, Wastes, Sewage, Water pollution sources, Sewage disposal, Judicial decisions, Rivers, Relative rights, Riparian waters.

Plaintiff brought an action for damages against defendant railroad company, an upper riparian owner, for unreasonable interference with plaintiff's riparian rights. Plaintiff contended that defendant unreasonably diverted waters from a river and discharged unreasonable quantities of sewage therein so as to hinder operation of plaintiff's sawmill located upon the river. Defendant contended that such use was not unreasonable. The court held that a riparian owner has a right to use and enjoy the benefits of a river and that such right includes a right to discharge a reasonable amount of sewage therein and to divert a reasonable quantity of water therefrom. Resultantly, a lower riparian's right to the use of a stream is a right qualified by the rights of upper riparians to make prior reasonable use of the waters. Whether or not use or detention of water by the upper riparian is unreasonable depends upon the peculiar circumstances of each case. From an examination of the evidence, the court found that defendant's diversion was relatively slight and that the sewage discharged was small so as to preclude a claim of unreasonable use. (Snow-Florida)
W71-00518

HOWLAND V UNION BAG AND PAPER CORP (RIPARIAN RIGHTS ATTENDANT TO OWNERSHIP OF NON-NAVIGABLE WATERCOURSE'S STREAMBED).
156 Misc 507, 282 NYS 357-367 (1935).

Descriptors: *New York, *Riparian rights, *Ownership of beds, *Natural flow, Riparian land, Non-navigable waters, Banks, Natural flow doctrine, Alteration of flow, Judicial decisions, Obstruction to flow, Beds, Relative rights, Riparian waters, Streambeds, Streams, Stream flow, Flow, Dams, Backwater.

In an action for damages, plaintiff contended that defendant corporation, by constructing a dam downstream, had violated his riparian right to the natural flow of the stream in that such dam retarded the stream's flow. Defendant contended that plaintiff was not in possession of any riparian rights since a railroad company had condemned for a right of way a portion of plaintiff's land appurtenant to the stream so as to sever any prior existing riparian rights. The court held that the condemnation by the railroad company did not affect plaintiff's riparian rights in that plaintiff still owned the bed of the non-navigable stream so as to entitle him to riparian rights even though he did not now own the bank of the stream. However, plaintiff could recover only nominal damages for the destruction of the riparian right since plaintiff was precluded from using the stream's bank, and thus was precluded from effectively using the stream. (Snow-Florida)
W71-00519

EWANSKI V SOLVAY PROCESS CO (LIABILITY FOR DEPOSITION OF INDUSTRIAL WASTE UPON LAND WHEN STREAM OVERFLOWS).
227 App Div 597, 238 NYS 508-512 (1930).

Descriptors: *New York, *Waste disposal, *Waste water disposal, *Overflow, Streams, Disposal, Wastes, Water pollution sources, Water pollution, Chemical wastes, Industrial wastes, Damages, Water pollution effects, Floods, Judicial decisions, Banks, Legal aspects.

In an action for damages, plaintiff contended that defendant manufacturing company deposited upon his land certain noxious and deleterious matter. Plaintiff contended that defendant discharged manufacturing refuse into a stream and that when such stream overflowed its banks in times of high water, the waste material was deposited on plaintiff's property, thus interfering with plaintiff's use of such property. Defendant recognized liability for such condition, but contended that the measure of damages was erroneously determined. The court held that there was no permanent injury to plaintiff's land and that therefore the effects of the nuisance was to be measured as the difference between the rental value before and after the waste was deposited upon the land. The court remanded the case for a redetermination of damages by such standard. (Snow-Florida)
W71-00520

ADIRONDACK POWER AND LIGHT CORP V CITY OF LITTLE FALLS (RIPARIAN RIGHT TO UNALTERED RIVER'S FLOW).
For primary bibliographic entry see Field 06D.
W71-00521

CITY OF LOCKPORT V MCCOLLUM (RIGHT OF CITY TO ABATE NUISANCE CAUSED BY OBSTRUCTION TO STREAMFLOW).
235 App Div 106, 256 NYS 283-284 (1932).

Descriptors: *New York, *Obstruction to flow, *Stagnant water, *Abatement, Standing waters, Streams, Streamflow, Flow, Downstream, Judicial decisions, Riparian waters, Riparian land, Public benefits, Public health, Cities, Remedies.

In a per curiam decision, the court ruled that plaintiff municipality could abate a nuisance in the form of stagnant pools which resulted from the failure of defendant, a downstream riparian owner, to clean out a watercourse and remove obstructions which he had placed therein. Plaintiff could remove the obstructions placed in the stream by defendant provided it could be shown that a public nuisance existed. However, the facts before the court were insufficient to establish such a public nuisance, and the case was remanded for a new trial to determine such issue. (Snow-Florida)
W71-00522

HUDSON V CARMICHAEL (INJUNCTION TO PROHIBIT CONTINUED MAINTENANCE OF A DAM).
181 SE 853-856 (Ga 1935).

Descriptors: *Georgia, *Damsites, *Contracts, *Backwater, Dams, Streams, Water levels, Weirs, Negotiations, Control, Retardance, Ponding, Reservoirs, Natural flow, Obstruction to flow, Dam construction, Electric power production, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction against defendant's maintenance of a dam which caused the water in a stream to back up on plaintiff's property. Defendant claimed that she had received permission for such ponding from plaintiff's predecessor in title and had orally contracted with plaintiff for continuing the operation of the dam. Plaintiff argued that such a contract was void because it dealt with an interest in land and as such was covered by the statute of frauds. The injunction was denied by the trial court, but the Supreme Court of Georgia reversed for a new trial, holding that certain testimony concerning the ultimate purpose of the dam being for electric power production was irrelevant and prejudicial to plaintiff's claim. (Barker-Florida)
W71-00523

COOK V TOWN OF MEBANE (MUNICIPALITY'S LIABILITY FOR DIVERSION AND POLLUTION OF STREAM).
131 SE 407-413 (1926).

Descriptors: *North Carolina, *Water pollution effects, *Damages, *Reasonable use, Water pollution sources, Water pollution, Diversion, Riparian rights, Natural flow, Path of pollutants, Pollutants, Municipal wastes, Sewage odor, Public health, Diseases, Value, Cities, Streams, Remedies, Relative rights, Judicial decisions, Legal aspects.

Plaintiffs, riparian owners, operated a mill on a stream below defendant municipality. Defendant diverted the flow of the stream at one point and discharged sewage into the stream at another, both of which were upstream from plaintiffs' mill. Plaintiffs claimed that such diversion substantially impaired their riparian right to undiminished flow and that the sewage discharge created a nuisance. Defendant argued that the diversion was a reasonable use by an upstream owner and that its sewage system had been approved by proper health officials. The trial court found for plaintiffs and awarded damages for both allegations. The Supreme Court of North Carolina, affirming the lower court's ruling, held that the instructions concerning the riparian right to undiminished flow, subject to the reasonable use of upstream riparian owners, and the evidence concerning the alleged nuisance were properly submitted to the jury. Defendant was liable for the reduction in value of plaintiffs' property. (Barker-Florida)
W71-00524

MOSES V TOWN OF MORGANTON (JOINT LIABILITY OF SEVERAL POLLUTERS).
192 NC, 133 SE 421-424 (1926).

Descriptors: *North Carolina, *Remedies, *Water pollution sources, *Water pollution, Impaired water quality, Path of pollutants, Pollutant identification, Pollutants, Riparian rights, Wastes, Industrial wastes, Odor, Water pollution effects, Fishkill, Fouling, Color, Aesthetics, Effluents, Municipal wastes, Damsites, Dams, Cities, Organic wastes, Judicial decisions, Legal aspects.

Plaintiff landowner brought suit against defendants, a municipality, an electric power corporation, and a shoe manufacturer, for damages caused to a stream on plaintiff's property. Plaintiff claimed that the city had discharged effluents from its sewer system into the river and that the shoe company had emptied noxious animal remains into the creek above plaintiff's land. The power company had constructed a dam below plaintiff's property thus retarding the flow of the water and causing the waste matter to accumulate on plaintiff's land. Plaintiff brought one action against all three defendants, and defendant shoe company, an out of state corporation, sought removal to federal court on the grounds that defendants were not joint tort-feasors. The Supreme Court of North Carolina ruled that if parties, although acting independently, know or have reasonable ground to believe that their independent acts, combined with the independent acts of others, will create a result that will become a nuisance, and they do so cause damage, they become joint tort-feasors ab initio and are liable as joint tort-feasors. The removal was denied. (Barker-Florida)
W71-00525

LINEBERGER V RUBY COTTON MILLS, INC (INJUNCTION AGAINST SEWER MAINTENANCE).
146 SE 215-216 (NC 1929).

Descriptors: *North Carolina, *Sewers, *Damages, *Sewage disposal, Sewage effluents, Riparian waters, Streams, Riparian rights, Relative rights, Industrial plants, Industrial wastes, Water pollution, Water pollution sources, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction against defendant corporation's maintenance of its sewers whereby sewage was allegedly discharged into a creek which ran through plaintiff's land. Defendant argued that what damage may have been done to plaintiff's land and the creek was the result of action by others and that defendant was in no way connected to such damage. The trial court denied the injunction and the Supreme Court of North Carolina affirmed, saying that plaintiff had not met the burden of showing the trial court's finding of facts to be erroneous. (Barker-Florida)
W71-00526

ANDERSON V TOWN OF WAYNESVILLE (MUNICIPALITIES' LIABILITY FOR POLLUTION CAUSED BY SEWAGE DISCHARGE).
164 SE 583-88 (NC 1932).

Descriptors: *North Carolina, *Sewage disposal, *Water pollution, *Remedies, Water pollution sources, Water pollution effects, Damages, Impaired water quality, Path of pollutants, Pollutant identification, Pollutants, Wastes, Municipal wastes, Odor, Aesthetics, Effluents, Sewage, Cities, Lakes, Streams, Public health, Bacteria, Sewage baceria, Judicial decisions, Legal aspects.

Plaintiffs, a church corporation and several individuals, owned a lake used for church functions and various recreational activities. Defendant municipalities operated sewage systems which discharged raw sewage into a stream which emptied into the lake, thus causing severe pollution and a threat to health. Plaintiffs sought damages for the past actions of defendants and injunctions, both temporary and permanent, against further pollution of the lake. The trial court granted the relief sought, but the Suprme Court of North Carolina reversed. It was held that the facts determined by the lower court were not reviewable and that plaintiffs had not lost their cause of action by laches. However, the court held that only a preliminary mandatory injunction could be granted pending a ruling by the jury on the defendants' liabilities to plaintiffs for the alleged nuisance. (Barker-Florida)
W71-00527

WATKINS V PEPPERTON COTTON MILLS (PRESCRIPTIVE RIGHT TO DUMP SEWAGE).
134 SE 69-71 (Ga 1926).

Descriptors: *Georgia, *Water pollution, *Prescriptive rights, *Streams, Water pollution sources, Wastes, Water pollution effects, Abatement, Sewage effluents, Cesspools, Sewage disposal, Industrial plants, Legal aspects, Judicial decisions, Sewage sludge, Damages.

Plaintiff landowner sought an injunction against defendant cotton mills to prevent defendant from continuing to use its sewage system which emptied raw sewage into the creek which flowed across plaintiff's land. Plaintiff contended that defendant's sewage system was polluting the creek which plaintiff used for a public bathing pool and whose water plaintiff used for domestic purposes. Defendant contended that it had poured sewage into the creek at a point miles above the point at which it flowed into plaintiff's land for 26 years prior to the action and had thus acquired a prescriptive right to do so. Furthermore, defendant contended tat it was not the source of the pollution because its raw sewage would be purified by the time the creek reached plaintiff's land. The Supreme Court of Georgia held that defendant had acquired a prescriptive right to dispose of its sewage in the creek. (Quesada-Forida)
W71-00528

MOBILE AND O RR V RED FEATHER COAL CO (LIABILITY FOR OBSTRUCTION TO FLOW OF INTERMITTENT STREAM).
119 So 606-610 (Ala 1928).

Descriptors: *Alabama, *Riparian rights, *Embankments, *Flood damage, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Natural flow doctrine, Proprietary power, Relative rights, Riparian land, Riparian waters, Usufructuary right, Watercourses (Legal), Damages, Excess water (Soils), Surface waters, Floods, Intermittent streams, Alteration of flow.

Defendant railroad's right-of-way crossed a stream which flowed across plaintiff's land on which several coal mine shafts were located. Defendant's trestle located on such right-of-way did not obstruct the streamflow until defendant constructed an earth embankment across the stream. The stream overflowed during 3 separate rainstorms as a result of said embankement, causing plaintiff's wells to be damaged by floodwater. Among other affirmative defenses, defendant offered proof that the stream was intermittent, being dry part of the year. The court held that injuries caused by obstructing and diverting the flow of waters constitute a private nuisance and are actionable as such. It further held that diverting waters from an intermittent stream is governed by the same rules of law as diverting those of a running stream. Defendant was granted a new trial, however, on the grounds that plaintiff had failed to mitigate his damages. (Clarke-Florida)
W71-00529

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
163 So 431-433 (La 1935).

Descriptors: *Louisiana, *Damages, *Oil wastes, *Brine disposal, Boundaries (Property), Judicial decisions, Legal aspects, Land tenure, Proprietary power, Relative rights, Riparian rights, Watercourses (Legal), Discharge (Water), Oil wells, Flooding, Flood damage, Intermittent streams, Saline water, Overflow.

Defendant drilled oil wells near plaintiff's land. Salt and waste water from the wells caused an intermittent branch stream across plaintiff's land to overflow, thus destroying a small amount of pasture and timber. The court recognized plaintiff's right to damages for injuries to his land caused by such overflow. The court limited damages, however, to the value of the timber actually destroyed. The court found that there was no material decrease in the fair market value of the land because the slight damage to the pasturage was temporary. (Clarke-Florida)
W71-00530

RHODES V INTERNATIONAL PAPER CO (LIABILITY FOR DAMAGES CAUSED FOR DISCHARGE OF INDUSTRIAL WASTES).
174 La 49, 139 So 755-757 (1932).

Descriptors: *Louisiana, *Pulp and paper industry, *Pulp wastes, *Damages, Chemical wastes, Watercourses (Legal), Crop response, Waste water (Pollution), Chemicals, Flooding, Usufructuary right, Overflow, Basins, Pollutants, Pollutant identification, Creeks, Drainage water, Waste water disposal, Legal aspects, Judicial decisions, Water pollution.

Plaintiff landowner sought damages for injury to her land allegedly caused by defendant paper company's pollution of a stream traversing her property. Defendant contended that plaintiff had failed to prove that the damage to her property was due to the chemical wastes it emtied into the stream. After considering the record, the court held that plaintiff had failed to meet the required burden of proof. The judgment for plaintiff was set aside, and plaintiff's demands were rejected. (Price-Florida)
W71-00531

BOARD OF LEVEE COMM'RS V MANGUM (RIGHT TO HAVE STREAM FLOW IN NATURAL COURSE MAY BE EXPRESSLY OR IMPLIEDLY WAIVED).
153 So 820-823 (Miss 1934).

Descriptors: *Mississippi, *Pumping plants, *Flow augmentation, *Erosion, Alteration of flow, Levees, Flood control, Flooding, Flood prevention, Judicial decisions, Legal aspects, Watercourses (Legal), Mississippi River, Top soil Water level fluctuations, Seepage, Floodwater, Drainage programs, Riparian land, Riparian waters, Riparian rights, Flow rates.

Plaintiff landowner sought damages for erosion to his property caused by the increased velocity of the stream flow generated by defendant's pumping plant. Defendant contended plaintiff was estopped from recovering because he had requested that the capacity of the pumping station be increased and had acquiesced and consented to the construction of the plant. The court stated that the undoubted right of a riparian owner to have the free use of the flow of water through his lands may be waived, and he may so act as to be estopped from asserting his claim to damage because of the alteration of the course or manner of the flow f the water. This license may be implied or given in parol. The court held that plaintiff was so estopped, and the trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-00532

JOHNSON V GIFFORD-HILL AND CO (LIABILITY FOR CHOKING OF STREAM CAUSED BY DEPOSITION OF SEDIMENT).
175 La 806, 141 So 842 (1932).

Descriptors: *Louisiana, *Water demand, *Deposition (Sediments), *Damages, Gravels, Watercourses (Legal), Judicial decisions, Legal aspects, Crop response, Relative rights, Riparian land, Riparian waters, Riparian rights, Sands, Streams.

Plaintiff landowner sought damages for crop loss, diminution in the value of his land, and loss of the operation of his cane mill. Such losses allegedly were cuased by the deposition of sand from defendant's gravel mill which choked the stream flowing by plaintiff's property. The court stated that there was little doubt as to defendant's liability, but that plaintiff took his damages too seriously. The five hundred dollars granted at the trial court was deemed sufficient to remedy plaintiff's water loss via the drilling of a well, and there would be some left over to compensate plaintiff for his crop disappointment. The trial court's judgment was affirmed. (Price-Florida)
W71-00533

GUILLORY V FONTENOT (PROPER USE OF FLOODGATES NOT AN OBSTRUCTION TO NATURAL DRAINAGE OF LAND).
170 La 345, 127 So 746-748 (1930).

Descriptors: *Louisiana, *Floodgates, *Flood irrigation, *Obstruction to flow, Watercourses (Legal), Drainage, Flooding, Irrigation, Impounded waters, Impoundments, Lakes, Diversion structures, Cultivated lands, Cultivation, Water storage, Artificial watercourses, Legal aspects, Judicial decisions.

Plaintiff upper landowner brought suit to have defendant lower landowner remove floodgates which allegedly obstructed the natural drainage of his property. Defendant contended that his floodgates were properly constructed and properly supervised during use, that his gates were never used until after plaintiff's lands were drained and that the use of his gates had never caused plaintiff damage. The court found that defendant's floodgates in no way impeded the current in the stream, that the gates were constructed by defendant's father at the request and with the consent of plaintiff and that plaintiff was now trying to evade the lawful contract he had previously entered with defendant's father. The judgment for defendant was affirmed. (Price-Florida)
W71-00534

WHEELER V RIVER FALLS POWER CO (LIABILITY OF POWER COMPANY FOR VIOLATION OF BOARD OF HEALTH'S REGULATIONS).
111 So 907-910 (Ala 1926).

Descriptors: *Alabama, *Diversion dams, *Impoundments, *Public health, Watercourses (Legal), Dams, Legislation, Impounded waters, Non-navigable waters, Diversion structures, Legal aspects, Judicial decisions, Regulation, Standards, Supervisory control (Power), Administrative agencies, Public utilities.

Plaintiff brought action against defendant power company alleging that the construction of a dam and impoundment of water by defendant was in violation of regulations of the state Board of Health and that such violations had caused plaintiff to become sick, and to suffer physical pain and mental anguish. The court stated that defendant was a corporation with the statutory power to construct dams and divert water from a non-navigable stream (as was involved in the instant case) if done in accordance with the regulations of the state Board of Health. However, the regulations allegedly violated were passed by a minority of the Board and were therefore invalid. The trial court's judgement for defendant was affirmed. (Price-Florida)
W71-00535

NAUVOO BLACK CREEK COAL CO V JOHNSON (LIABILITY FOR SUBSTANTIAL INJURY CAUSED BY STREAM POLLUTION).
For primary bibliographic entry see Field 05C.
W71-00536

STANDARD OIL CO V GOODWIN (FOULING OF LANDS BY ESCAPE OF SEDIMENT FROM STORAGE TANKS).
299 SW 2-5 (Ark 1927).

Descriptors: *Arkansas, *Damages, *Sediment discharge, *Sediment distribution, Watercourses (Legal), Levees, Oil, Pollutants, Pollutant identification, Riparian land, Riparian rights, Riparian waters, Oil fields, Oily water, Embankments, Fouling, Judicial decisions, Legal aspects, Industrial wastes.

Plaintiff landowner sought damages for injury to his property allegedly caused by the escape of crude oil and basic sediment from defendant oil company's storage pits. The sediment was carried across plaintiff's land via a natural watercourse. Defendant denied plaintiff's allegations and contended that any damage to plaintiff was temporary. Defendant also contended that the measure of damages, if any, should be the difference between the rental value of the land before and after the sediment deposition. The court held that the injury was permanent. The court ruled that the proper measure of damages was the difference between the fair market value of the land prior to and after the injury. The judgment for plaintiff was affirmed. (Price-Florida)
W71-00537

CHAPMAN V AMERICAN CREOSOTING CO (LIABILITY FOR POLLUTION OF WELLS AND SPRINGS).
286 SE 837-841 (Mo 1926).

Descriptors: *Missouri, *Creosote, *Water pollution sources, *Industrial wastes, Wastes, Water pollution control, Springs, Wells, Deepwells, Legal aspects, Judicial decisions, Waste water treatment, Subsurface waters, Remedies, Pollutants, Damages, Overflow.

Plaintiff landowner brought an action for damages against defendant corporation which plaintiff contended was polluting his well and spring by discharging creosoting wastes. Plaintiff contended that defendant negligently maintained its creosoting vats and that it allowed poisonous fluids to overflow into a ravine which led into plaintiff's land. Plaintiff sought damages for destruction of his grazing land, his water sources and his livestock, asserting that the waste products in his water sources were the proximate causes of such damage. Defendant contended that the overflow was caused by an unforeseen, unusually heavy rainfall which was an act of God. In holding for plaintiff, the court found that there was no evidence of extraordinary rainfall and that there was sufficient evidence upon which it could be found that defendant's creosote wastes had polluted plaintiff's wells and springs. (Quesada-Florida)
W71-00538

GREISINGER V KLINHARDT (IMPLIED EASEMENT FOR THE MAINTENANCE OF WATER LEVEL OF LAKE IN UPLAND LANDOWNER).
9 SW2d 978-983 (Mo 1928).

Descriptors: *Missouri, *Water levels, *Dams, *Easements, Concrete structures, Legal aspects, Judicial decisions, Diversion, Remedies, Diversion structures, Competing uses, Recreation, Relative rights, Riparian rights, Lakes, Overlying proprietor.

Plaintiff upper riparian landowner sought to enjoin defendant lower riparian landowner from draining the waters of an artificial lake. Plaintiff contended that a common grantor of plaintiff and defendant had constructed the dam which divided the lake

into two parts, one of which was later sold to plaintiff. Plaintiff further contended that by such division, the grantor had burdened the lower land and created an implied easement for the maintenance of the water level in the lake in favor of the upper landowner upon severance of the two portions by sale. Defendant contended that he was draining the water from the upper portion only to the extent necessary to effect repairs in the dam. The Supreme Court of Missouri held that plaintiff had acquired such an implied easement, and, upon finding that defendant had not in good faith lowered the level of the lake, issued an injunction prohibiting defendant from any further draining activities. (Quesada-Florida)
W71-00539

LATONIA REFINING CORP V DUSING (OIL REFINERY LIABLE FOR STREAM POLLUTION).
246 Ky 328, 55 SW2d 23-26 (1932).

Descriptors: *Kentucky, *Damages, *Industrial wastes, *Water pollution, Water injury, Pollutant identification, Watercourses (Legal), Non-navigable waters, Creeks, Oily water, Legal aspects, Judicial decisions, Oil, Oil industry, Oil wastes, Water demand, Pollutants, Relative rights, Water pollution effects.

Plaintiff landowner sought damages for defendant oil refinery's pollution of a stream which flowed through his property. Defendant emptied oily water into the stream. During heavy rans, such water was washed away and no accumulation occurred on the stream surface. During the year involved there was a drought, and considerable pollution occurred. Defendant contended the pollution was an act of God. Had it rained as usual, no pollution would have resulted from its actions. Defendant also contended there was no other way to operate its business and that adjoining landowners must yield to some inconvenience caused by the use of its property. The court stated that one cannot provide the conditions for a disaster and then claim it was an act of God. The court did not concede that defendant had a right to pollute the non-navigable stream on which it was located. The business was brought to the land, not placed there by nature, and no public necessity required t to be there. Damages were held to be that amount necessary to fairly and reasonably compensate plaintiff for the diminution in the value and use of his property. The judgment for plaintiff was affirmed. (Price-Florida)
W71-00540

NORTON COAL MIN CO V WILKEY (POLLUTION OF STREAM AND FARM BY COAL MINING WASTES).
232 Ky 539, 23 SW2d 942-945 (1930).

Descriptors: *Kentucky, *Water pollution, *Streams, *Coal mine wastes, Farms, Agriculture, Crops, Crop production, Water pollution sources, Water pollution effects, Pollutants, Coal mines, Hydraulic mining, Rent, Economic rent, Compensation, Legal aspects, Judicial decisions, Adjudication procedure, Industrial wastes.

Plaintiff landowner sued defendant coal mining company for damages from pollution injury. A stream coursed through plaintiff's land, and defendant discharged coal mining wastes into the stream. Plaintiff claimed damages for injury to his farm and crops caused by this pollution of the creek. In an appeal on procedural issues, the court held that the evidence presented was a sufficient standard for measuring damages, and that the damages awarded were not excessive. The decision of the lower court for plaintiff was affirmed. (Hart-Florida)
W71-00541

HUNZE V CITY OF CAPE GIRARDEAU (LIABILITY FOR STREAM POLLUTION BY MUNICIPALITY).
43 SW2d 882-883 (Mo 1931).

Descriptors: *Missouri, *Water pollution, *Easements, *Condemnation, Eminent domain, Sewers, Cities, Water pollution effects, Water pollution sources, Pollutants, Surface runoff, Storm drainage, Judicial decisions, Legal aspects, Adjudication procedure, Runoff, Storm runoff, Excess water (Soils), Sewage effluents, Municipal wastes, Sewage disposal.
Identifiers: *Nuisance.

Plaintiff landowner sued defendant city for damages from pollution. Defendant condemned an easement across plaintiff's land to install a sewer line, and also condemned an easement in a stream which crossed plaintiff's land for the discharge of excess surface water mixed with sewer effluent in times of heavy rainfall. The sewer clogged, and defendant diverted the sewer into the stream continuously, surcharging the stream easement. Defendant contended that the condemnation proceeding was res judicata to the instant action, and that proof of negligence was required for the recovery of damages. The court held that since the instant action was only for damages resulting from the easement surcharge, the condemnation proceeding was not res judicata. Furthermore, the court held that in actions for damages for injury from creation of a nuisance, proof of negligence was not required, and affirmed the lower court's judgment for plaintiff. (Hart-Florida)
W71-00542

SHELLEY V OZARK PIPELINE CORP (CHARACTERIZATION OF OIL PIPELINE LEAK AS TEMPORARY OR PERMANENT NUISANCE).

37 SW2d 518-523 (Mo 1931).

Descriptors: *Pipelines, *Oil, *Water wells, *Missouri, Water pollution sources, Oil industry, Oily water, Water pollution, Pollutants, Legal aspects, Judicial decisions, Adjudication procedure, Groundwater, Wells, Water supply, Damages, Compensation, Remedies, Farm ponds, Stock water, Leakage.
Identifiers: *Oil leaks.

Plaintiff farmers brought an action against defendant oil company to recover damages caused by oil leaking from defendant's pipeline on plaintiffs' property, thereby contaminating plaintiffs' water supply. Plaintiffs had already recovered in a prior action for similar damage but contended that a new leak had caused further damage since the prior action. Defendant argued that plaintiffs had alleged in the first action that the oil damage was a permanent nuisance and therefore were barred from bringing another action since they should have recovered all their damages in the first action, although they only recovered in part. Reversing a judgment for defendant, the court held that a pipeline leak was a temporary, rather than a permanent nuisance despite plaintiffs' allegations to the contrary. Therefore, plaintiffs could not have recovered for future damages in the first action and were not barred from bringing a second action. (Liptak-Florida)
W71-00543

CALIFORNIA OREGON POWER CO V BEAVER PORTLAND CEMENT CO (UNAPPROPRIATED WATER UNDER THE DESERT LAND ACT AS SUBJECT TO STATE RULES OF APPROPRIATION).

295 US 142, 55 S Ct 725-732 (1935).

Descriptors: *Desert Land Act, *Appropriation, *Water rights, *Unappropriated water, Beneficial use, Public lands, Non-navigable streams, Governments, Natural flow, Riparian rights, Legal aspects, Judicial decisions, United States, Reservation doctrine, State jurisdiction, Arid lands, Reclamation, Obstruction to flow, Federal jurisdiction.

Plaintiff power company sued to enjoin defendant cement company from interfering with the natural flow of a stream which flowed between plaintiff's and defendant's property. Plaintiff argued that its patent from the United States carried with it the riparian right to the uninterrupted flow of water past its property. Defendant contended that, except for previously exercised rights, state legislation had established the rule of prior appropriation and since plaintiff had not put the water to any beneficial uses, defendant's right of appropriation was not restricted. Affirming a judgment for defendant, the court held that the Desert Land Act, establishing a rule of appropriation as to unappropriated water, was not binding upon the states. The final choice of a rule was left to the individual states. Therefore, the state court's interpretation of its own rule as one of appropriation, rather than one of riparian rights must stand. (Liptak-Florida)
W71-00544

BRAIDBURN REALTY CORP V CITY OF EAST ORANGE (WITHDRAWAL OF GROUNDWATER FROM CONDEMNED PROPERTY AS AN ELEMENT OF DAMAGES).
153 A 714-716 (NJ 1931).

Descriptors: *New Jersey, *Groundwater, *Drawdown, *Condemnation value, Water supply, Cities, Wells, Eminent domain, Percolation, Damages, Compensation, Legal aspects, Judicial decisions, Water table, Withdrawal, Consumptive use, Water demand, Legislation, Assessments, Relative rights.

Defendant city condemned plaintiffs' land primarily for the purpose of withdrawing the groundwater beneath the property to augment the city water supply. Plaintiffs claimed that they were entitled, not only to the value of the land taken, but also to damages to injury to their adjoining property resulting from the drawdown of the water level. The court held the plaintiffs, as condemnees, were entitled to recover for damage to their remaining land resulting from any use to which the condemned land was to be put. Therefore, to the extent that the withdrawal of water from the condemned property interfered with plaintiffs' reasonable use of the groundwater subjacent to their remaining property, recovery was allowed. The case was remanded to the lower court for assessment of these damages. (Caldwell-Florida)
W71-00545

WHITE RIVER CHAIR CO V CONNECTICUT RIVER POWER CO (DEFENDANT'S DAM ALLEGED TO HAVE RAISED WATER LEVELS, FLOODING PLAINTIFF'S PROPERTY).
162 A 859-872 (Vt 1932).

Descriptors: *Vermont, *Dams, *Seepage, *Subsurface drainage, Flood damage, Overflow, Hydroelectric plants, Damages, Water levels, Dikes, Percolation, Legal aspects, Drainage, Groundwater movement, Saturation, Structures, Slopes, Relative rights, Flooding, Obstruction to flow, Judicial decisions, Subsurface flow, Diversion, Drainage effects.

Plaintiff corporation claimed that defendant power company's dam had so raised the water levels in the surrounding area as to cause seepage onto plaintiff's property. Also, the natural drainage of the property was alleged to have been interfered with, resulting in plaintiff's basement being flooded and the soil being saturated. The court found no evidence to support plaintiff's claim that the dam had caused seepage directly onto the property from the dam's millpond. A lower court finding that dikes built to keep water from overflowing onto plaintiff's property were impervious to percolation was upheld. Plaintiff's contention that interference with the natural drainage of groundwater gave ground for relief was also rejected by the court, holding that rules granting recovery for obstruction of surface drainage did not apply to groundwater movement. Defendant was entitled to overflow his property up to the boundary with plaintiff's land, and any effect of such overflow on subsurface drainage was held non-compensable. (Caldwell-Florida)
W71-00546

JESSOP V PASSAIC VALLEY WATER COMM'N (PRIOR APPROPRIATION BY PREDECESSOR IN INTEREST ESTABLISHED ADVERSE USE WHICH PASSED TO SUCCESSOR).
174 A 254-257 (NJ 1934).

Descriptors: *New Jersey, *Prior appropriation, *Diversion, *Riparian rights, Relative rights, Reasonable use, Legal aspects, Judicial decisions, Competing uses, Consumptive uses, Water allocation (Policy), Water distribution (Applied), Water utilization, Industrial water, Water users, Natural flow, Water demand.

Plaintiff riparian landowner sought to enjoin defendant water commission from diverting water from the river at a point above where plaintiff diverted water for commercial uses. Plaintiff contended that defendant was interrupting the natural flow of the river and that it should cease such interruption or cause plaintiff's land to be condemned. Defendant claimed a prescriptive right to divert the water as the successor in title of a water company. The Court of Chancery of New Jersey haeld that while the period during which the predecessor to defendant diverted water could not be counted as part of any prescriptive period, the use of the water was competent evidence to show to what extent defendant's predecessor had acquired diversion rights by adverse use. On this basis, the court held that plaintiff was entitled to an injunction against a diversion in excess of the amount which defendant had acquired the right to divert from its grantor. (Quesada-Florida)
W71-00547

CITY OF JOHNSTOWN V FEARL (ATTEMPT BY CITY TO REMOVE STRUCTURES WITHIN CHANNEL LINES OF STREAM).
176 A 20-22 (Pa 1935).

Descriptors: *Pennsylvania, *Obstruction to flow, *Cities, *Structures, Legislation, Channel flow, Ownership of beds, Non-navigable waters, Boundary disputes, Boundaries (Property), Legal aspects, Eminent domain, Channels, Channel improvement, Riparian land, Condemnation, Compensation.

Plaintiff city sought, by having them declared a public nuisance, to remove structures constructed by defendant within the channel lines of a river. The court held that the structures were not public nuisances, and that defendant could not be forced to remove them through abatement proceedings. The proper procedure was for the city to condemn defendant's property and remove the structures after it had gained title to the land. Because the stream was non-navigable, defendant's property extended to the middle of the stream. The fact that a statute had declared the stream to be a public waterway was held not to have deprived defendant of his title to the streambed. The value of this property had to be taken into account in any future condemnation action. (Caldwell-Florida)
W71-00548

PURYEAR V NIELSON (EFFECTS OF SURFACE WATER DIVERSION ON ADJACENT LANDOWNER).
211 NW 676-677 (Minn 1927).

Descriptors: *Minnesota, *Damages, *Storm runoff, *Diversion structures, Surface waters, Ditches, Diversion, Sand pits, Runoff, Gravel, Flooding, Floodwater, Dikes, Topography, Basins, Judicial decisions, Legal aspects, Diversion losses, Surface runoff, Relative rights.

Plaintiff sued defendant for damages alleged to have resulted from defendant's construction of a ditch and dike to protect his premises from surface water. The court ruled that there was too much evidence indicating that water would have gone onto plaintiff's property, and his buildings surrounded by water, even if no ditch or dike had been constructed. The burden was on plaintiff to show not only his damage, but also that defendant's ditch was the cause of such damage. Since plaintiff failed to so prove, the judgment for plaintiff was reversed. (Price-Florida)
W71-00549

BESLER V GREENWOOD (INJUNCTION TO PREVENT OBSTRUCTING NATURAL FLOW OF DRAINAGE WATER).
For primary bibliographic entry see Field 04A.
W71-00550

6F. Nonstructural Alternatives

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.

Virginia Polytechnic Institute and State University Water Resources Center Bulletin 39, July 1970. 138 p, 3 append. OWRR Project A-999-VA (9).

Descriptors: *Flood control, *Flood plain zoning, *Planning, *Virginia, Cities, Urbanization, Flood protection, Economics, Surveys, Hydrologic data, City planning, Area redevelopment, Governments, Legislation, Non-structural alternatives.
Identifiers: Flood plain planning.

To assist local governments in Virginia in coping with flood problems, the Virginia Water Center organized a seminar to show that something could be done at the local level, to highlight the economics associated with flooding, to provide detailed information about the federal and state assistance available, and to hear the testimony of community leaders who have reduced their flood losses with the financial and technical assistance available. This bulletin contains the papers presented at the seminar. (Knapp-USGS)
W71-00002

FLOOD PLAIN INFORMATION, MINNESOTA RIVER, GRANITE FALLS, MINNESOTA.
Corps of Engineers, St Paul, Minn.
For primary bibliographic entry see Field 04A.
W71-00026

FLOOD PLAIN INFORMATION, BEARGRASS AND UPPER MILL CREEKS, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00054

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AND CAPE LA CROIX CREEK, CAPE GIRARDEAU, MO.
Corps of Engineers, St. Louis, Mo.
For primary bibliographic entry see Field 04A.
W71-00055

FLOOD PLAIN INFORMATION, OHIO RIVER, KENTON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00065

FLOOD PLAIN INFORMATION, OHIO RIVER, CAMPBELL COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00066

FLOOD PLAIN INFORMATION, FLORENCE, SOUTH CAROLINA.
Corps of Engineers, Charleston, S.C.
For primary bibliographic entry see Field 04A.
W71-00067

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER (LOMPOC TO PACIFIC OCEAN), SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W71-00208

FLOOD PLAIN INFORMATION, WHITE OAK CREEK, ROCK CREEK AND TOWN BRANCH, SULPHUR SPRINGS, TEXAS.
Corps of Engineers, New Orleans, La.
For primary bibliographic entry see Field 04A.
W71-00224

THE LOCAL-STATE-FEDERAL TEAM APPROACH TO FLOODPLAIN MANAGEMENT,
Tennessee Valley Authority.
John W. Weathers.
In: Water Resources Bulletin, Vol 6, No 1, February 1970, p 106-109.

Descriptors: *Planning, *Coordination, *Flood plains, State governments, Cities, Institutions, Federal government, Non-structural alternatives, Tennessee River, Tennessee Valley Authority Project, Land management.
Identifiers: *Flood plain management, *Flood plain information.

Results of the establishment of a local Flood Relations program in 1953 by TVA are discussed. In sixteen years, TVA has produced local flood plain information reports for 126 communities. As of September 1, 1969, 66 valley communities had adopted both. The local-state-federal team approach to floodplain management is viable and any other appears to be doomed to failure. The floodplain management program can be expected to succeed as a collaborative effort by all levels of government, each playing a part and assuming the responsibilities best fitted to it. Most of us now accept that our flood problems will not be solved by engineering works alone or even in combination upstream land management. The solution requires a linking of broad community planning with traditional engineering works. This means that the local, state and federal objectives and policies must be effectively coordinated. This method has been developed and satisfactorily applied in the Tennessee Valley during the past decade. Since a working relationship with the people of the Valley and their state and local institutions had been carefully nutured for by TVA for over twenty years, it was only natural that the new program would also be a cooperative one. (Marriott-Chicago)
W71-00313

FLOOD CONTROL AND DRAINAGE IN INDIA,
Central Water and Power Commission, New Delhi, (India).
For primary bibliographic entry see Field 04A.
W71-00400

REMOTE SENSING FOR RESOURCE MANAGEMENT AND FLOOD PLAIN DELINEATION,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 07B.
W71-00415

6G. Ecologic Impact of Water Development

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
Harold A. Paulsen, Jr., and Elbert H. Reid.
Department of Agriculture Miscellaneous Publication No 1147, May 1970. 220 p.

Descriptors: *Wildlife habitats, *Habitat imporvement, *Remote sensing, *Range management, *Ecology, Grazing, Pasture management, Soil conservation, Carrying capacity, Conservation, Ranges, Grasslands, Land use, Wildlife management, Surveys, Investigations, Data collections.

Identifiers: Range and wildlife habitat surveys.

A symposium collection of 30 papers discusses evaluation of range and wildlife habitat. The major topics discussed include: forage evaluation for livestock and wildlife, remote sensing, and status, applications, and research needs in range and wildlife ecology. The papers are presented in the following sections: animal production and forage quality, factors influencing forage quality, determining forage quality, determining animal consumption, remote sensing, and range and wildlife habitat ecology-status and challenges. (Knapp-USGS)
W71-00209

07. RESOURCES DATA

7A. Network Design

THE ARCHIVES FOR GROUNDWATER LEVELS T.N.O. IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
For primary bibliographic entry see Field 02F.
W71-00144

A PROPOSED STREAMFLOW DATA PROGRAM FOR MICHIGAN,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02E.
W71-00199

7B. Data Acquisition

DETECTION AT A DISTANCE OF EMERGENCE OF THE GIRONDE BY INFRARED RADIOMETRY. RELATIONS WITH THE COASTAL DRAINAGE CHANNELS (IN FRENCH),
Alain Cazal, Pierre Pouchan, and Jean Vouve.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 760-763, 1970. 1 fig, 4 ref.

Descriptors: *Analytical techniques, Spectroscopy, Infrared radiation, Remote sensing, Underground streams, Water, Temperature, Rivers, Hydrogen ion concentration, Estuaries, Water circulation.
Identifiers: River temperature bands, Thermal profiles, Gironde Estuary (France), Seudre River (France), Radiometry.

The use of the infrared radiometry permitted the detection of the enrichment of the Gironde estuary by hard water of underground currents possessing a higher temperature than that of the estuary. The equipment included a radiometer recording infrared radiation with wave length between 8 and 14 microns. A continuous recording of data registered by an airborne thermometric device was effected photographically. The assembly was equipped with a system of differential amplification and provided a sensibility of 0.05C. The technique encountered several obstacles, such as adjustment or calibration difficulties, complications due to currents of diversified nature, high air humidity, and limitations connected with the recording of solely surface temperatures. Nevertheless, the study was able to reveal the pattern of circulation of water flowing from the important network of the karstian plateau. (Wilde-Wisconsin)
W71-00111

DETERMINATION OF ORGANIC MATTER BY PERMANGANATE OXIDATION. XIII. CONTRIBUTION TO THE DETERMINATION OF OXIDABILITY OF PHENOLIC WATERS (IN CZECHOSLOVAKIAN),
Kharlova Universita, Prague (Czechoslovakia).
Antonin Berka, and Zdenek Zavesky.
English summary. Chemicke Listy, Vol 63, p 1148-1152, 1969. 3 tab, 8 ref.

Descriptors: *Organic matter, *Water analysis, *Analytical techniques, *Oxidation, Phenols, Analysis, Chemistry, Effluents.
Identifiers: Potassium permanganate, Sodium carbonate, Sulfuric acid, Oxalic acid.

The oxidation of phenol containing substances by permanganate was conducted in 1 mole solution of sodium carbonate and subsequently in a solution acidified by sulfuric and oxalic acids. In a simplified version of the procedure, the titration is accomplished with 0.1 mole fraction potassium permanganate. The described method achieves a significantly higher degree of oxidation of phenolic compounds in comparison with the 4-hour iodometric analyses. (Wilde-Wisconsin)
W71-00113

PERMEABILITY OF CRYSTALLINE ROCK INTERPRETED FROM MEASURED ORIENTATIONS AND APERTURES OF FRACTURES,
Ceara Univ., Fortaleza (Brazil). Dept. of Geosciences; and Colorado School of Mines, Golden.
Luiz Bianchi, and David T. Snow.
Annals of Arid Zone, Vol 8, No 2, p 231-245, September 1969. 13 fig, 2 tab, 14 ref.

Descriptors: *Permeability, *Crystalline rocks, *Fractures (Geology), *Isotropy, On-site data collections, Theoretical analysis, Colorado, Geology, Hydrogeology, Mathematical models, Groundwater, Instrumentation, Sampling, Rocks.
Identifiers: *Rock apertures, *Groundwater exploration, Penetrants.

Accelerating demands for groundwater supplies have created an increased interest in the subject of fractured crystalline rock permeability. A mathematical model of intersecting plane conductors approaches real fracture geometry, affording insight into its permeability characteristics. The theory is used to compute the permeability of Pike's Peak Granite from observed orientations and measured apertures. A line sampling method was utilized in which a maximum number of fractures could be measured. The sampling line was oriented in the direction of central tendency of the normals to the fractures and it was assumed that fracture frequencies and orientations beyond the sampling line were identical to those along the sample. Sampling lines along outcroppings were established with surveyors tape at 59 sampling stations. A penetrant-photographic method was used for measurement of fracture apertures and its strengths and weaknesses are discussed. It was found that apertures were log normally distributed and the surface apertures were much larger than subsurface apertures but size predictability at various depths was impossible from the data. Until measurements can be made in depth in undisturbed rock, direct permeability computations cannot be made. However, an extensive mathematical method for estimating permeabilities from fracture orientations is described. (Casey-Arizona)
W71-00151

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1966-67,
Geological Survey, Washington, D.C.
Rita K. Llaverias.
Available from NTIS as PB-192 863, $3.00 in paper copy, $0.95 in microfiche. Geological Survey Interagency Report-189, May 1970. 127 p, 412 ref, 4 index.

Descriptors: *Bibliographies, *Remote sensing, *Information retrieval, *Water resources, Publications, Aerial photography, Agronomic crops, Forestry, Geomorphology, Geologic investigations, Glaciation, Hydrologic data, Meteorological data, Instrumentation, Methodology, Oceanography, Range management, Soil classifications, Urbanization, Satellites (Artificial).
Identifiers: *Earth resources data, Photographic techniques.

This is the second in a series of bibliographies on remote sensing of earth resources applications. The subject matter coverage is extended from the earlier more restricted area of hydrology to the broader field of earth resources, but the emphasis on water resources applications remains. Citations are given for 412 literature items appearing in 1966-1967, and represent such fields as agriculture, forestry, geography, geology, hydrology, meteorology, oceanology, range management, and urban planning. Indexes are provided for personal and corporate authors and subject. Each citation has three key word descriptors. (Lang-USGS)
W71-00173

EVALUATION OF INSTALLATION METHODS FOR NEUTRON-METER ACCESS TUBES,
Geological Survey, Idaho Falls, Idaho; and Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02G.
W71-00187

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
For primary bibliographic entry see Field 06G.
W71-00209

TREND-SURFACE ANALYSIS OF GROUNDWATER FLUCTUATIONS,
Missouri Univ., Rolla.
For primary bibliographic entry see Field 02F.
W71-00259

INTEGRATING-FLOAT MEASUREMENTS AT LOW VELOCITIES,
Missouri Univ., Columbia; and Tennessee Valley Authority, Norris.
For primary bibliographic entry see Field 08B.
W71-00273

DEVELOPMENT OF A RESISTANCE-WIRE WAVE GAUGE FOR SHALLOW-WATER WAVE AND WATER-LEVEL INVESTIGATIONS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Stanton G. Truxillo.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 73-76, February 1970. 4 p, 3 fig, 2 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Water level fluctuations, *Gages, *Waves (Water), Electrical equipment, Conductivity, Instrumentation, Beaches, Tides, Surf, Surveys, On-site tests.
Identifiers: Wave gages.

A resistance-wire gage was developed for measuring water level fluctuations, including waves, in shallow waters. The stainless-steel wire is set in a spiral groove cut in 3/4 inch PVC pipe. Because the wire is protected in a groove in the PVC pipe, the staff is much more rugged and more safely portable than are the classical wave staffs where the wire is simply stretched between two insulating end posts. In addition, the spiral groove means that there is a large length of wire per unit length of staff, so the staff is electrically linear to within 1 percent after only 4 inches of staff is submerged. The high resistance per unit length produces a large output voltage with a small power supply, permitting use of the very simple and inexpensive oscillator and detector circuits shown. The circuit uses readily available parts and has the advantages of reliability, portability (with a 12-volt auto battery as power source), low current drain (less than 1 amp), and stability. (Knapp-USGS)
W71-00357

A NEW 'BASELESS' PROPORTIONAL WEIR,
Indian Inst. of Science, Bangalore (India). Dept. of Civil and Hydraulic Engineering.
N. S. Lakshmana Rao, and D. Chandrasekaran.

Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 341-355, 1970. 15 p, 6 fig, 3 plate, 2 tab, 7 ref.

Descriptors: *Discharge measurement, *Weirs, Discharge (Water), Water levels, Stage-discharge relations, Data collections, Water measurement, Flow measurement, Stream gages.
Identifiers: Proportional weirs.

The proposed new weir has some definite advantages over other types of weirs such as the exponential, logarithmic, sutro, quadratic, rectangular, triangular and parabolic weirs. Experimental verification of the head discharge relation is made for a typical weir and the coefficient of discharge is found to be 0.60. (Knapp-USGS)
W71-00359

REPEATABILITY OF THREE INSTRUMENTS USED TO DETERMINE THE UNDRAINED SHEAR STRENGTH OF EXTREMELY WEAK, SATURATED, COHESIVE SEDIMENTS,
Naval Oceanographic Office, Washington, D.C.
Joseph H. Kravitz.
Journal of Sedimentary Petrology, Vol 40, No 3, p 1026-1037, September 1970. 12 p, 6 fig, 3 tab, 30 ref.

Descriptors: *Test procedures, *Sediments, *Shear strength, *Instrumentation, Mechanical properties, Materials testing, Testing, Analytical techniques, Statistics, Quality control, Measurement.
Identifiers: Fall cone, Vane shear-testing, Torvane, Weak sediments.

Relative repeatability studies were made of the fall cone, motorized laboratory vane and torvane, when testing the undrained shear strength of extremely weak, saturated, cohesive sediments. The 26 sediment samples tested were collected from an artificial settling pond, tested for shear strength and analyzed for their chemical, mineralogical and physical properties. The fall cone showed the best repeatability with the motorized laboratory vane next and the torvane last. The individual repeatability of all three devices when testing extremely weak sediments is poor. Differences among the instruments were not significant at the 5 percent level. Instrument characteristics and testing methods rather than sediment characteristics are most likely responsible for differences among the instruments and for the low repeatability. None of the instruments are especially well suited for testing extremely weak sediments. Because of its greater repeatability the fall cone is preferred to the other two devices. (Knapp-USGS)
W71-00389

REMOTE SENSING FOR RESOURCE MANAGEMENT AND FLOOD PLAIN DELINEATION,
Wisconsin Univ., Madison. Dept. of Soil Science.
C. J. Milfred, D. E. Parker, and G. B. Lee.
Available from NTIS as PB-195 086, $3.00 in paper copy, $0.95 in microfiche. Reprint, Presented at the 24th Midwestern States Flood Control and Water Resources Conference, May 21-22, 1969, Milwaukee, Wisconsin. 17 p. OWRR B-002-WISC (11).

Descriptors: *Flood plain zoning, *Hydrologic data, *Soil surveys, *Aerial photography, Remote sensing, Radar.
Identifiers: Multiband photography, Infrared sensors, Multispectral sensors.

Remote sensing is becoming an extremely important research tool in modern resource management techniques. Water resource managers can use remote sensing systems to provide supplemental information in regions where planning has been hampered by the lack of suitable hydrologic data and other resource information. Continued pressure for encroachment and development on flood plains will generate a need for more comprehensive planning based on timely and accurate information about an entire river basin or watershed. With respect to flood plain delineation, remote sensors cannot be used to predict the height of future floods. They can provide information to indicate areas that have flooded which should help improve flood predictions based on theoretical models. Remote sensors offer a dynamic resource inventory system which can be used to complement traditional detailed studies and serve as an important source of information in regions where detailed studies are not available. Remote sensors generate a great deal of data and there is danger of accumulating more information than can be utilized. This problem can be largely overcome by maintaining a close working relationship between scientists working on applications of the sensors and resource managers who will use the information to help solve important natural resource problems.
W71-00415

SPATIAL SURVEILLANCE OF NATURAL RESOURCES,
Royal Aircraft Establishment, Farnborough (England).
D. I. Raitt.
Available from NTIS as N70-21145, $3.00 in paper copy, $0.95 in microfiche. Library Bibliography No. 308, January 1969. 23 p.
Identifiers: *Bibliographies, *Earth resources, *Satellite-borne photography, Aerial photography, Infrared photography, Remote sensors, Satellite observation, Surveillance.

This selective bibliography covers the period 1944 to date in general the coverage is of the following fields mineral deposits agriculture (vegetation, crops, soils), forestry (disease, fire), wildlife, livestock and water resources. A select list of references on applications satellites is also included.
W71-00452

MICROSCOPIC OPEN CHANNEL BOUNDARY LAYER VELOCITY MEASUREMENT USING A VERTUAL IMAGE METHOD,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 08B.
W71-00470

7C. Evaluation, Processing and Publication

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 04A.
W71-00025

GEOLOGIC MAP OF THE LOWER CACHE LA POUDRE RIVER BASIN, NORTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00049

SEDIMENT YIELDS OF WISCONSIN STREAMS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W71-00050

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).
For primary bibliographic entry see Field 06A.
W71-00071

A STATISTICAL ANALYSIS OF THE RAINFALL OVER THE SUDAN,
Khartoum Univ. (Sudan). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-00159

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W71-00165

RECONNAISSANCE BATHYMETRY OF PYRAMID LAKE, WASHOE COUNTY, NEVADA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02H.
W71-00189

BRIEF DESCRIPTIONS OF AND EXAMPLES OF OUTPUT FROM COMPUTER PROGRAMS DEVELOPED FOR USE WITH WATER DATA IN KANSAS,
Geological Survey, Lawrence, Kans.
Brent H. Lowell, Charles O. Morgan, and Jesse M. McNellis.
Kansas Geological Survey Special Distribution Publication 48, 1970. 54 p, 41 fig, 17 ref, append.

Descriptors: *Computer programs, *Data processing, *Hydrogeology, *Kansas, Hydrologic data, Water level fluctuations, Streamflow, Regression analysis, Mapping, Suspended load, Bed load, Sediment transport, Statistics, Statistical methods, Hydraulics, Channel morphology.
Identifiers: Water data computation.

Programs written in FORTRAN IV language were developed in the Kansas District of the U.S. Geological Survey to handle basic water data by use of the digital computer. The programs check, tabulate, graph, map, and statistically analyze data derived from hydrologic and geologic investigations. This report contains brief descriptions of and output from some of the digital computer programs. It is not meant to give detailed program information, but rather to acquaint the reader briefly with many of the programs that are currently available in Kansas for use with water data. All programs are written in FORTRAN IV programming language and are operational on the GE 635 computer at The University of Kansas Computation Center. The described programs can be used, with minor adaptations, on any computer with a FORTRAN IV compiler. Operational programs are separated into three general groups; checking and tabulation programs, standard analysis programs, and other programs. Additional programs that are in the development stage include: a program for performing a multitude of operations on water-level records including change maps for selected periods and regression analysis, a program for plotting graphically the suspended- and bed-load sediment data, and a program to treat statistically the parameters considered in hydraulic geometry of channels. (Knapp-USGS)
W71-00193

A COMPUTER METHOD FOR PUMPING-TEST ANALYSIS,
New Mexico Tech., Socorro. Research and Development Div.
For primary bibliographic entry see Field 02F.
W71-00197

GEOLOGY AND WATER RESOURCES OF CAMPBELL COUNTY, SOUTH DAKOTA; PART III-BASIC DATA,
South Dakota State Geological Survey, Vermillion, and Geological Survey, Vermillion, S. Dak.
For primary bibliographic entry see Field 02F.
W71-00210

T-WAVE, A COMPUTER CODE FOR ANALYZING THE NONSTEADY GRAVITY DECAY OF A GROUNDWATER ANOMALY,
California Univ., Livermore. Lawrence Radiation Lab.
John A. Korver.
Available from NTIS, as TID 4500, UC 35, price $3.00 paper copy, $0.95 microfiche. California University, Lawrence Radiation Laboratory UCRL-50830, March 16, 1970. 59 p, 3 fig, 2 ref, 5 append.

Descriptors: *Computer programs, *Mathematical models, *Water levels, *Groundwater movement, Water level fluctuations, Infiltration, Tracers, Permeability, Porosity, Hydrogeology.
Identifiers: T-Wave, Groundwater mounds.

The T-WAVE code is based on a one-dimensional numerical model describing the gravity decay of a groundwater mound. The Fortran program for the T-WAVE Code may be used to examine the time-dependent flow characteristics of anomalous groundwater mounds resulting from underground nuclear explosions near or below the regional water table. The code allows the permeability and porosity to be in either a cylindrical or spherical geometry surrounding the shot point, and it also allows for internal horizontal or vertical discontinuities of the permeability or porosity. It also possible to follow the horizontal displacement of ideally tagged water particles as a function of time. (Knapp-USGS)
W71-00211

OCEANS IV: A PROCESSING, ARCHIVING AND RETRIEVAL SYSTEM FOR OCEANOGRAPHIC STATION DATA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
H. E. Sweers.
Canada Department of Energy, Mines and Resources, Marine Sciences Branch Manuscript Report Series No 15, 1970. 137 p, 62 fig, 15 tab, 22 ref.

Descriptors: *Data storage and retrieval, *Computer programs, *Oceanography, Marine geology, Oceans, Data collections, Hydrologic data, Data processing, Information retrieval, Networks, Stations, Meteorological data, Gravity, Geophysics, Water temperature.
Identifiers: Oceanographic data.

OCEANS IV is a powerful system of programs used by the Canadian Oceanographic Data Centre to manage its oceanographic station data file. This file, at present, contains 30,000 stations consisting of, on the average, 10 observed levels each. The data are stored in geographical order on magnetic tape. The system can accept up to 35 different physical and chemical parameters in a partically open ended format. To date only 16 parameters have been assigned codes. The four basic functions of the OCEANS IV system are: (1) processing of reversing thermometer readings; (2) preparing temperature, salinity and chemical data for archival in the oceanographic station data file; (3) printing data reports on request; and (4) providing a flexible retrieval of data from the file. (Knapp-USGS)
W71-00352

AUTOMATIC DEVICE FOR PLOTTING PROFILES OF HYDRAULIC MODELS,
Alberta Univ., Edmonton. Dept. of Electrical Engineering.
Y. J. Kingma.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 329-339, 1970. 11 p, 7 fig, 2 ref.

Descriptors: *Hydraulic models, *Instrumentation, *Sediment transport, *Profiles, *Channel morphology, Data collections, Light, Water levels, Sedimentary structures, Dunes, Ripple marks, Alluvial channels, Measurement.
Identifiers: Optical water-level measurement.

An optical probe is used as the sensor of an automatic hydraulic model contour follower. The sensor consists of a light source, a split lightpipe, and a photodiode. With an electromechanical servo system the probe is kept at a fixed, small distance from the contour to be measured. As the servo driven probe assembly is moved across the mode, output signals proportional to the horizontal and vertical displacements are fed into an X-Y plotter, thus producing a profile of the model. The accuracy is better than 0.8 mm. (Knapp-USGS)
W71-00360

MRIS BULLETIN-DEVELOPMENT ISSUE.
National Academy of Sciences-National Research Council, Washington, D.C. Maritime Research Information Service.
For primary bibliographic entry see Field 10.
W71-00395

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 05G.
W71-00478

08. ENGINEERING WORKS

8A. Structures

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-00012

CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES,
Connecticut Argicultural Experiment Station, Storrs; California Univ., Davis; and California State Dept. of Public Works, Sacramento.
For primary bibliographic entry see Field 05D.
W71-00137

ON THE DESIGN AND CONSTRUCTION OF INFILTRATION GALLERIES,
Truman W. Bennett.
Groundwater, Vol 8, No 3, p 16-24, May-June 1970. 9 p, 1 fig, 8 ref.

Descriptors: *Galleries, *Infiltration, Drainage, Drains, Water yield, Drainage engineering, Recharge, Drawdown, Aquifer characteristics, Well screens, Pipes, Filters, Design, Construction, Sumps, Wells, Operation and maintenance, Subsurface drains, Subsurface drainage.
Identifiers: Drain filters, Pumping tests, Infiltration rate, Filter criteria, Construction methods.

Present knowledge regarding factors controlling yield and maintenance requirements of infiltration galleries permits a more accurate evaluation than is generally employed. Pump test procedures and the analysis necessary for a reliable prediction of the yield of infiltration galleries are outlined. Gallery design, including pipe size, pipe materials, slot size, filter materials, and sump size, is discussed. Gallery construction by installing permeable conduit in an open excavation and backfilling and by pipe projection from a central caisson are discussed. Rules for successful operation and maintenance procedures for the most prevalent difficulties occurring in gallery installations are suggested. (USBR)
W71-00258

DESIGN OF CARTERS PUMPED STORAGE PROJECT,
Army Engineer District, Mobile, Ala.
Walter W. Burdin.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No P03, p 383-400, June 1970. 18 p, 9 fig, 1 tab, 12 ref, append.

Descriptors: *Multiple-purpose projects, Recreation, Geology, Design, *Electric power production, Flood control, Rockfill dams, Construction, Reservoirs, *Pumped storage, Penstocks, Hydraulic turbines, Costs, Pump turbines, Georgia, Spillways, Hydroelectric plants, Earth dams.
Identifiers: *Carters Project (Ga).

The Carters Project is under construction on the Coosawattee River about 75 mi north of Atlanta, Ga. When completed in 1974, the project will consist of a 440-ft-high, rockfill main dam with a powerhouse on the right bank, an emergency spillway on the left bank, and a low, earth and rockfill reregulation dam about 2 mi downstream of the main dam. The powerhouse, of conventional enclosed design, will contain 4 units. Nominal generator rating for each of the 4 units is 125,000 kw. The 2 conventional Francis turbines are rated at 172,000 hp at 345 ft net head and 163.6 rpm. The 2 pump-turbines are rated as turbines at 173,000 hp at 345 ft net head and as pumps at 4,435 cfs at 347 ft total head, both at 150 rpm. Normal operating head at maximum power pool elevation 1072.0 will be about 385 ft. The multipurpose project is being developed for flood control, recreation, and power. The geology, hydrology, and design of the project are discussed. (USBR)
W71-00270

EFFECT OF SAFETY FACTOR AND CONCRETE STRENGTH ON COST OF ARCH DAMS,
Harza Engineering Co., Chicago, Ill.
Roman P. Wengler.
Paper, Conference on Rapid Constr of Concrete Dams, Pacific Grove, Calif, Mar 1970. 9 p, 3 tab.

Descriptors: *Arch dams, *Safety factors, *Dam design, *Costs, Stress, Safety, Dam construction, Yield point, Volume, Formwork (Construction), Cooling, Cost comparisons, Hydrostatics, Temperature, Loads (Forces), Stability, Concrete dams, Dams.
Identifiers: Concrete properties, Design strength, Ultimate strength, Cooling systems, Cost savings.

A study made to determine the effect on cost of arch dams for various safety factors concluded that if the safety factor is to be reduced, keeping the concrete strength constant and reducing concrete volume are definitely more advantageous than keeping the concrete volume constant and reducing strength. If the concrete strength is kept constant and volume is reduced, a savings of 12% is achieved by reducing the safety factor from 4 to 3 and 22% by reducing it from 4 to 2. The effect on cost of increasing the concrete strength while keeping the safety factor constant was small. The question arises as to whether or not a safety of 4 at one yr as traditionally defined is really necessary. This is a complex question involving a multitude of intangibles. Safety factors are used to build in provisions for all underlying uncertainties. The safety factor probably could be decreased as the uncertainties decreased because of improvement in design and construction techniques and improvement of instrumentation measurement techniques for studying prototype behavior of dams. While this alone may not be adequate justification for reducing safety factors, the question seems to warrant further discussion. (USBR)
W71-00272

SMALL WELLS MANUAL--A MANUAL OF LOCATION, DESIGN, CONSTRUCTION, USE AND MAINTENANCE,
Minnesota Univ., Minneapolis. Div. of Environmental Health.
Ulric P. Gibson, and Rexford D. Singer.
Department of State Agency for International Development (AID) Manual, 2nd Printing, Sep-

tember 1969. 156 p, 108 fig, 3 tab, 23 ref, 2 append.

Descriptors: *Water wells, *Drilling, *Water resources development, Pumps, Pumping, Rotary drilling, Well screens, Well casings, Well filters, Water quality, Water yield, Water supply, Water pollution control.
Identifiers: Small wells manual, Well design, Well construction.

This manual is intended to serve as a basic introductory text book and to provide instruction and guidance to field personnel engaged in the construction, operation and maintenance of small diameter, relatively shallow wells used primarily for individual and small community water supplies, particularly in developing parts of the world. It is aimed particularly at those persons who have had little or no experience in the subject. An attempt has been made to treat the subject matter as simply as possible in order that this manual may be of benefit not only to the engineer or other technically trained individual (inexperienced in this field) but also the individual home owner, farmer or non-technically trained community development officer. This manual should also prove useful in the training of water well drillers, providing the complementary background material for their field experience. (Knapp-USGS)
W71-00305

BURIED ASPHALT MEMBRANE CANAL LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 04A.
W71-00433

HAZARDS TO PEOPLE AND ANIMALS FROM BUREAU-CONSTRUCTED CANALS, OPEN AND CLOSED CONDUIT SYSTEMS PROGRAM,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Howard Latham, and James M. Verzuh.
Available from NTIS as PB-190 005, $3.00 in paper copy, $0.95 in microfiche. January 1970. 48 p. REC-OCE-70-2.
Identifiers: *Inland waterways, Hazards, Safety, Animals, Drowning, Water supplies, Humans, Irrigation systems, Economics, Construction.

Approximately 30 people drown in Bureau-constructed canals annually. An undetermined number of animals (mostly deer) also drown in these canals. Losses could be eliminated at considerable expense by covering existing canals or by placing them in buried conduits. Human and animal losses can be reduced at moderate expense by constructing adequate fencing. A survey of human drownings and a review of safety practices and policies are presented. Data relating to animal losses are provided. Unit costs of placing canals in buried conduits, covering canals and fencing canals are illustrated. Other suggested safety solutions, such as using stepped or corrugated canals linings and allowing canals and rights of way to be used for recreational purposes are examined. Recommendations for reducing drownings are given.
W71-00437

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
T. H. Wu.
Available from NTIS as PB-193 112, $3.00 in paper copy, $0.95 in microfiche. Interium Report EES-279-2. September 1969. 120 p.
Identifiers: *Roads, Sands, *Structures, Drainage, Interactions, Shear stresses, Pipes, Deflection, Compressive properties, Strain (Mechanics), Flexible structures, Mathematical models, Ohio, *Culverts, Soil stabilization.

Triaxial and 'trapdoor' tests were conducted on a sand to determine its stress-strain properties. Results of tests by Waterways Experiment Station and others are included in the report. Measured stresses compared closely to computed stresses. Computed deflections were many times greater than measured deflections for an undetermined reason. The report includes a print out of a finite element computer program developed by Brown of California and modified by the researchers to take into account nonlinear soil properties. Using the program, preliminary calculations were made for one set of conditions to illustrate the nature of results obtainable.
W71-00441

THERMAL ANALYSIS OF ABOVE-GROUND LIQUID DISTRIBUTION SYSTEMS (UTILIDORS) FOR POLAR APPLICATION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
C. K. Smith.
Available from NTIS as AD-707 695, $3.00 in paper copy, $0.95 in microfiche. Technical Note N-1090, May, 1970. 34 p.
Identifiers: *Polar regions, Pipes, *Pipes, Thermal insulation, *Thermal insulation, Thermal analysis, Freezing, Structural shells, Configuration, Heat transfer, Mathematical models, Numerical analysis, Computer logic, Computer programs, Utilidors, Computer analysis.

In polar regions, service distribution pipes for water, sewage, and heating present special problems becuase they cannot be buried in the normal manner. One solution to this problem is to install an above-ground utilidor, which consists of a thermally insulated box-like structure through which the service lines run. One or more of the service lines provides the source of heat necessary to avoid freezing of all the other lines. A basic proolem in utilidor design is that the system must provide sufficient thermal protection to avoid freezing during coldest weather, but the temperatures of the liquids being distributed must not become undersirably high during warm weather. Therefore, thermal performance must be analyzed at both extremes of ambient and operating conditions before the utilidor design for a particular site is finalized. The document presents a general analysis and resulting computer program suitable for prediction of the thermal performance of various multi-pipe utilidor designs over a wide range of boundary conditions. The computed results are shown to compare favorably with experimental data for a particular design. The computer program is described, and sample calculations are presented.
W71-00465

FIELD AND LABORATORY TESTS FOR SAFETY OF DAMS INVESTIGATION AT SALT RIVER PROJECT, ARIZONA,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08F.
W71-00466

STANDARD UTILITY LOCATIONS FOR THE CITY OF PHOENIX.
Standard Utility Locations Committee, Phoenix, Ariz.

June 1970. 17 p, 20 fig.

Descriptors: *Utilities, *Urbanization, *Locating, *Municipal water, *Municipal wastes, *Sewers, *Right-of-way, *Road design, *Water conveyance, *Public utilities, *Distribution systems, Irrigation systems, Trenches, Conduits, Pipes, Design standards, Cross-sections.
Identifiers: *Utility locations, *Utility standards, *Standard utility locations, Phoenix.

Standards are described that will serve as guidelines for the installation and relocation of all utility services within public rights-of-way in the City of Phoenix. Very few municipalities in the United States have adopted comprehensive utility location standards and fewer have been published. Because of urban growth and added demands for public services such as potable water, irrigation water, sewerage, power, communication, heating fuel and others, more efficient use must be made of underground and aboveground space in public rights-of-way. It is also desirable to locate utility services so that street cuts and traffic interference are minimized. The report specifies the required location of utility conduits, pipes, cables, or poles in typical street types by means of cross-sectional sketches. The standards require a minimum thirty inches of cover over all underground utilities located in paved areas of streets, except for irrigation water pipe which must have eighteen inches. Domestic water lines, and sanitary and storm sewers are always placed in the street area along major and collector routes, whereas irrigation water lines are located in the sidewalk area. Along local streets, domestic water lines are located beyond the sidewalk, adjacent to property lines; however, sewers are within the street area. Sanitary sewers are also permitted in alleys and on easements. (Poertner)
W71-00484

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-00499

8B. Hydraulics

TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
For primary bibliographic entry see Field 10.
W71-00015

SEDIMENT SAMPLING EFFICIENCY OF SLOTS,
Iowa Univ., Iowa City; and Technion - Israel Inst. of Technology, Haifa.
For primary bibliographic entry see Field 02J.
W71-00016

EXPERIMENTAL INVESTIGATION OF FORM OF BED-ROUGHNESS,
Southeastern Massachusetts Univ., North Dartmouth, Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-00018

WATER WAVE PRESSURE ON HORIZONTAL PLATE,
Delaware Univ., Newark. Dept. of Civil Engineering.
Hsiang Wang.
Work supported by DASA. ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7629, p 1997-2017, October 1970. 21 p, 14 fig, 1 tab, 16 ref, append.

Descriptors: *Waves (Water), *Uplift pressure, *Shore protection, Standing waves, Hydraulics, Energy, Surges, Erosion, Erosion control, Pressure.
Identifiers: Water wave pressure.

Simple rules are developed to estimate the maximum uplift pressures induced on the underside of a flat plate by various types of incident waves. Theoretical prediction techniques are provided for both the slow-rise pressure component and the fast-rise pressure component (impact) for different incident waves: standing waves, regular progressive waves, and dispersive waves, all in constant water depth. Laboratory experiments were conducted in a dispersive wave basin partially to check the validity of prediction techniques and partially to provide additional information so that the prediction techniques can be extended empirically to cover the more complicated but more practical

situation of a plate in shoaling water. The fast-rise pressure should be of engineering concern not only because the magnitude of its peak is enormous but also because the magnitude of the corresponding impulse is significant. The slow-rise pressure component was found to range from one to two times the hydrostatic pressure. (Knapp-USGS)
W71-00019

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,
Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Harvey E. Jobson, and William W. Sayre.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7618, p 1983-1996, October 1970. 14 p, 8 fig, 1 tab, 12 ref, append.

Descriptors: *Sediment transport, *Turbulent flow, *Open channel flow, *Dispersion, Diffusion, Mass transfer, Turbulence, Sedimentation, Path of pollutants, Settling velocity, Model studies, Flumes, Hydraulic models, Mathematical models, Mixing, Computer programs.
Identifiers: Waste dispersion.

A steady state two-dimensional conservation of mass equation is solved numerically in order to describe the process of vertical mass transfer for both neutrally buoyant liquid and suspended sediment particles in an open channel flow. The relevancy of the equation is illustrated by comparing its solution with laboratory data obtained from experiments conducted in a large flume. The solution is then used to graphically illustrate the effects of various hydraulicparameters on mass transfer. Parameters investigated include the velocity distribution, the magnitude and distribution of the turbulent mass transfer coefficient, the particle fall velocity and the boundary conditions at the channel bed. The solutions indicate that the fall velocity controls the rate of descent of the dispersant mass but has little effect on the rate of spread of the dispersant. Conversely, the transfer coefficient controls the rate of spread of the dispersant but has little effect on its rate of descent. The most striking conclusion drawn from this study is that the dispersant distribution is not very sensitive to the distribution of the turbulent mass transfer coefficient. (Knapp-USGS)
W71-00020

VIRTUAL MASS OF PLATES AND DISCS IN WATER,
Frederic T. Mavis.
ASCE Proceedings, Journal of the Hydraulic Division, Vol 96, No HY 10, Paper 7593, p 1947-1952, October 1970. 6 p, 4 fig, 4 ref, append.

Descriptors: *Settling velocity, *Particle shape, Hydraulics, Laboratory tests, Viscosity, Instrumentation, Photography.
Identifiers: Virtual mass.

A method of studying virtual mass of plates and discs in linear-accelerated motion involves: (1) simple apparatus for strobophotographic recording of small displacements at the rate of 500 per sec within a test interval of 1/25 sec under the same initial force; and (2) analysis of data from wet and dry tests plotted on a trilinear chart with displacement as ordinate, mass as abscissa, and time intervals as parameter. Variability of data is reported. (Knapp-USGS)
W71-00022

UNSTEADY FLOW IN CHANNEL OF VARIABLE CROSS SECTION,
University of Strathclyde, Glasgow (Scotland).
For primary bibliographic entry see Field 02L.
W71-00023

WAVE-HEIGHT PREDICTION FOR WAVE GENERATORS IN SHALLOW WATER,
Army Coastal Engineering Research Center, Washington, D.C.
Cyril J. Galvin, Jr.
Available from NTIS as AD-440 880, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 4, Mar. 1964. 21 p.

Descriptors: *Beach erosion, *Shallow water, *Hydro dynamics.
Identifiers: *Wave-height, Wave generators, *Wave tanks.

The height of wave generated by displacement type wave generators in shallow water is approximately equal to 2piS/L times an appropriate dimension of the wave generator. S is the stroke of the wave generator, L is the wave length given by the small-amplitude theory, and the wave generator dimension is measured perpendicular to S. This relation agrees with the hydrodynamic theory for piston and flap-type wave generators over the range of relative depths usually used in coastal engineering experiments, and it agrees with data from four piston-type and two flunger-type wavegenerators for depths satisfying the condition (2piD/L) less than 1. This method of wave-height prediction can shorten the time spent on many coastal engineering experiments.
W71-00143

MODEL TESTS FOR A HORIZONTAL WELL,
For primary bibliographic entry see Field 02F.
W71-00198

CONSTRUCTION RECOMMENDATIONS, DESIGN CRITERIA AND THEIR APPLICATION,
Gabriel A. Echavez.
Transl from Spanish of Bur Reclam Transl 841, July 1970. 10 p, 3 fig, 2 tab. Nat Univ Mex, Inst Eng, No 226, p 151-161, Aug 1969.

Descriptors: *Cavitation, Erosion, *Spillways, Aeration, Construction, *Tunnels, *Design criteria, Roughness (Hydraulic), Fluid flow, *Pressure head, Vaporization, Velocity, Foreign research, Alinements, Finishing, Fluid mechanics, Mexico.
Identifiers: Cavitation control, *Cavitation index, *Recommendations, High velocity, Infiernillo Dam (Mex).

Erosion from cavitation in a high-velocity conduit such as a spillway tunnel is the primary factor to consider in construction; proper alinement and finishing are important. In addition, studying the possible use of aerating devices is advisable. A formula using roughness, pressure head, vaporization head, and bottom velocity is given for computing the coefficient of cavitation. An analysis of the spillway tunnels of the El Infiernillo Dam, Mexico, shows that the coefficient of cavitation decreases as the water velocity increases. When a bend is reached, the cavitation index increases because of an increase in pressure on the floor. The minimum value is found at the end of the bend; below the bend the cavitation index increases slowly because of a reduction in velocity close to the tunnel wall. The situation is more critical on the sidewalls than on the bottom because the depth is negligible on the bottom, provided there are no disalinements or isolated obstacles. (USBR)
W71-00264

INTEGRATING-FLOAT MEASUREMENTS AT LOW VELOCITIES,
Missouri Univ., Columbia; and Tennessee Valley Authority, Norris.
Henry Liu, and Larry D. Martin.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 96, No HY1, p 143-151, Jan 1970. 9 p, 1 fig, 1 tab, 7 ref, 2 append.

Descriptors: Hydraulics, Hydrology, *Open channel flow, *Floats, Flow, *Flow measurement, Instrumentation, *Stream gages, Streamflow, Fluid flow, Velocity, Laboratory tests, *Discharge measurement, Discharge (Water).
Identifiers: *Integrating-float method.

Accurate flow measurement by the integration-float method is possible if the method is used properly. Flow measurement by this method was tested in a rectangular flume 1 ft wide and 2 ft deep. Stainless steel hollow spheres, 5/8-in. dia were used as floats. Accuracy of the technique was evaluated by comparing discharges measured with floats to those measured with standard weirs. Despite the influence of flow nonuniformity on some measurements, the average error was only 2.4% for the range of velocities studied (0.02 fps to 0.3 fps); this error is much less than can be expected from conventional current meters at such low velocities. Because no apparent decrease in accuracy was observed for the lower range of velocities studied, the same accuracy can be expected at flows of even smaller velocities. The potential usefulness of the technique for streamflow measurement at low velocities should not be overlooked. (USBR)
W71-00273

ANALYSIS OF HYDRAULIC TESTS IN HOT CREEK VALLEY, NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00306

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00307

ESTUARY ENTRANCE UMPQUA RIVER, OREGON--HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
G. M. Fisackerly.
Report available from NTIS, Springfield, Virginia. Corps of Engineers, Waterways Experiment Station Technical Report H-70-6, May 1970. 20 p, 2 fig, 177 plate, 83 photo, 3 tab.

Descriptors: *Hydraulic models, *Oregon, *Estuaries, *Channels, Navigation, River training, Erosion control, Sedimentation, Channel improvement, Inlets (Waterways), Jetties, Coastal structures, Harbors, Shore protection.
Identifiers: Umpqua River (Ore).

The Umpqua River estuary model of the fixed-bed type, was constructed to scales of 1:300 horizontally and 1:100 vertically, to reproduce the lower 28 miles of the Umpqua River, Oregon and an adjoining portion of the Pacific Ocean. The model was equipped for accurate reproduction and measurement of tides, tidal currents, waves, salinity intrusion, freshwater inflow, shoaling distribution, and other significant prototype phenomena. The purpose of the model study was to determine the optimum plan for the reduction of shoaling and elimination of cross-currents in the navigation channel at the entrance. The model hydraulic and salinity regimens were in satisfactory agreement with those of the prototype for comparable conditions; therefore the model provided quantitative answers concerning the effects of the proposed plans on the hydraulic and salinity regimens of the estuary. The optimum plan consisted of existing conditions plus a 2600-ft extension of the training jetty to the outer end of the south jetty. Results of model tests indicate that the optimum plan can eliminate cross-currents without aggravating the wave climate or shoaling conditions. (Knapp-USGS)
W71-00308

HYDRAULICS OF BRIDGE WATERWAYS.
Bureau of Public Roads, Washington, D.C. Bridge Div.

For sale by Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402--Price $1.25. Bureau of Public Roads

Hydraulic Design Series No 1, Federal Highway Administration, 2d edition 1970. Bradley, Joseph N., Consultant. 111 p, 55 fig, 11 tab, 43 ref, 3 append.

Descriptors: *Stage-discharge relations, *Backwater, *Flow profiles, *Bridges, Abutments, Hydraulics, Streamflow, Discharge (Water), Water levels, Water level fluctuations.
Identifiers: Backwater computation (Bridges).

Design charts and methods are presented for a wide variety of bridge backwater problems. The method of computing backwater as presented is intended to be used for relatively straight reaches of streams having subcritical flow and approximately uniform slope. The design information applies specifically to the normal stage-discharge condition. The method described permits a direct solution for backwater but requires a trial solution for discharge. (Knapp-USGS)
W71-00350

MODEL SIMILARITY CONCERNING THE TRANSPORT OF SUSPENDED MATTER IN A TURBULENT FLOW FIELD,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
Mutlu Sumer.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 357-364, 1970. 8 p, 1 fig, 6 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Sediment transport, Model studies, Hydraulics, Settling basins, Settling velocity, Sedimentation rates, Particle shape, Particle size, Turbulent flow, Suspended load.
Identifiers: Model similarity.

Model similarity in studies of the transport of suspended matter in a turbulent flow field is investigated and the most general conditions that establish the equivalence between prototype and model are obtained. The results are applied to settling basins. Models may be constructed without distortion in order to give equivalence between prototype and model. (Knapp-USGS)
W71-00358

AUTOMATIC DEVICE FOR PLOTTING PROFILES OF HYDRAULIC MODELS,
Alberta Univ., Edmonton. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 07C.
W71-00360

DIMENSIONAL ANALYSIS OF ALLUVIAL CHANNELS WITH SPECIAL REFERENCE TO MEANDER LENGTH,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 02J.
W71-00361

HYDRAULIC JUMP WITHIN A GRADUALLY EXPANDING CHANNEL,
Asian Inst. of Tech., Bangkok (Thailand).
Alejandro U. Abella.
M.Eng. Thesis No 276, Asian Institute of Technology, 1970. 62 p, 16 fig, 6 tab, 20 ref.

Descriptors: *Hydraulic jump, *Open channel flow, *Energy dissipation, Stilling basins, Energy losses, Mathematical models, Hydraulic models, Alluvial channels, Stream erosion, Scour, Turbulent flow, Transition flow, Critical flow, Supercritical flow.
Identifiers: Circular hydraulic jump, Expanding flow.

Hydraulic jump occurring was studied in the transition of a gradually expanding channel. This expanding channel jump is considered to behave as a section of a circular jump. Equations describing the characteristics of the expanding channel jump are derived from the three basic principles of fluid flow. Observations were conducted using six different angles of divergence. The experimental results showed a close agreement with the theoretical solutions. The general equation developed for the jump, with proper evaluation of the side pressure force effect, describes well the phenomenon regardless of the angle of divergence. Expanding channel jump is relatively better than the jump in a rectangular channel for energy dissipation. An empirical expression for approximating the location of the jump within the transition was also developed. (Knapp-USGS)
W71-00383

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering; and Auburn Univ., Ala. Dept. of Agricultural Engineering.
E. Dale Threadgill, and Ronald E. Hermanson.
American Society of Agricultural Engineers Transactions, Vol 12, No 3, p 352-355, May-June, 1969. 4 p, 2 fig, 3 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Open channel flow, *Hydraulic models, Rainfall, Distribution, *Velocity, *Tractive forces, Model studies, Regression analysis, Temperature.
Identifiers: *Triangular open channel, Sensors.

The effect of rainfall on the velocity distribution and tractive forces in a shallow, triangular channel was determined in a research flume equipped with a rainfall simulator. All tests were conducted at each of three depths of flow, 2, 4, and 6 inches, measured at the centerline of the flume. Vertical velocity profiles were obtained at each of the flush-mounted sensors and at the centerline of the flume by taking point velocity readings with the cylindrical hot-film sensors. Readings of the point velocities and tractive forces were taken at each flow depth without rainfall and with each of the three rainfall intensities. All tests were made for flow over both the rough and the smooth boundary. The sensors were recalibrated if the temperature of the water or the cold resistance of the sensor changed. In general, rainfall did not have a significant effect on the velocity gradients for any rainfall intensity or flow depth. Analyses of the data are tabulated. (Woodard-USGS)
W71-00405

ENERGY DISSIPATION IN OPEN CHANNELS BY LARGE SEMI-CIRCULAR DISK ROUGHNESS ELEMENTS,
Asian Inst. of Tech., Bangkok (Thailand).
Eer-ruenn Charng.
M. Eng. Thesis No 232, Asian Institute of Technology, 1969. 66 p, 8 fig, 6 tab, 22 ref, append.

Descriptors: *Open channel flow, *Roughness (Hydraulic), *Hydraulic gradient, *Energy losses, Turbulent flow, Head loss, Flow resistance, Fluid friction, Flumes, Hydraulic models, Air entrainment, Manning equation, Froude number.
Identifiers: Steep channels.

Flume tests were conducted using semi-circular disks as roughness elements in steep channels. The disks were made of aluminum sheets. The relative depths investigated ranged from approximately 1 to 6. From the experimental results, no meaningful relationships could be found between the flow resistance, the relative depth and geometric parameters describing the channel shape. This indicated that other variables such as air entrainment and the Froude number of the flow, which were originally not considered to be significant, were important in describing the flow phenomenon. (Knapp-USGS)
W71-00406

DELAWARE RIVER MODEL STUDY, REPORT NO 1. HYDRAULIC AND SALINITY VERIFICATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Available from NTIS as AD-70 9741, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 2-337, May 1956. 113 p.
Identifiers: *Delaware Bay, Hydraulic models, *Estuaries, Salinity, Inland waterways, Tides, River currents, Water pollution, Wastes (Industrial), Wastes (Sanitary engineering), Drainage, Dams, Construction, Pennsylvania, Delaware, New Jersey, Rivers, *Delaware River, *Salinity intrusion, *Channel improvements, Salinity distribution, Fresh water discharge, Graphs (Charts).

The Delaware River model reproduces the entire estuarine portion of Delaware Bay and River from the Capes to Trenton, N.J. The model is of fixed-bed construction and is equipped with all necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinity intrusion, channel shoaling, and other significant phenomena of the prototype. The principal problems to be studied on the model are concerned with reduction of shoaling and salinity intrusion, although other problems of a lesser degree of importance will also be investigated. This report is concerned with the hydraulic and salinity verification of the model, and contains complete data showing the degree of accuracy attained with respect to duplication in the model of observed portotype phenomena.
W71-00443

AN EXPERIMENTAL STUDY OF TURBULENT DIFFUSION OF DRAG-REDUCING POLYMER ADDITIVES,
LTV Research Center, Dallas, Tex.
R. R. Walter, and C. S. Wells.
Available from NTIS as AD-709 455, $3.00 in paper copy, $0.95 in microfiche. April 1970. 38 p. ONR 062-422.
Identifiers: *Diffusion, *Additives, *Drag, Reduction, *Polymers, Skin friction, Turbulence, Injection, Pipes, Fluid flow, Thickness, Concentration (Chemistry), *Drag reducing fluids, Pipe flow.

An experimental study of the mechanics of turbulent diffusion when uniformly injecting a drag-reducing polymer solution through a wall adjacent to a fully developed pipe flow of water is described. Experimental diffusion data were obtained using very low injection rates in a porous wall pipe tos section designed on the basis of a prior theoretical diffusion analysis with uniform injection. The drag-reducing effectiveness of the polymer only in the wall region, discovered previously, is substantiated by detailed concentration profile, velocity profile and wall shear stress data. These data indicate that an increase in the viscous sublayer thickness is accompanied by an increase in the diffusion sublayer thickness for uniform drag-reducing polymer injection. Also, uniform polymer injection at the wall appeared to somewhat inhibit the turbulent diffusion away from the wall. This type of injection provided drag reduction with a much smaller supply of polymer than required to raise the concentration throughout the shear layer to the same drag-reducing level.
W71-00469

MICROSCOPIC OPEN CHANNEL BOUNDARY LAYER VELOCITY MEASUREMENT USING A VERTUAL IMAGE METHOD,
Illinois Univ., Urbana. Water Resources Center.
Harry G. Wenzel, and Kuo C. Chang.
Available from NTIS as PB-195 163, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center Research Report 31, April 1970. 31 p, 1 tab, 11 fig, 12 ref. OWRR Project A-026-ILL (1).

Descriptors: *Boundary layers, *Microscopy, *Open channel flow, *Tracers, Tractive forces, Velocity, Flow.

Identifiers: *Velocity measurement, Virtual image method.

A method for velocity measurement is described which employs a microscope and high speed motion picture camera to record the motion of small tracer particles suspended in the flow. The procedure, termed the image method, involves particle illumination such that the particle itself and its virtual image created by reflection from a boundary both appear on the film. The boundary is then located equidistant from the two images. The plane of focus is oriented normal to the boundary giving a picture of the entire velocity profile normal to the boundary within the limits of the field of view. A frame by frame analysis of the particle motion can yield velocity profile and turbulence information. The image method was adapted to a small open channel. Considerable difficulty was encountered in illuminating the particles with sufficient intensity to impress their image on the film. Thus, quantitative data was not obtained. It was concluded that the lens system used to focus the light source was inadequate. However, the method has potential applications in velocity measurement near a boundary and flow visualization studies.
W71-00470

HYDRAULIC GEOMETRY OF 12 SELECTED STREAM SYSTEMS OF THE UNITED STATES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02E.
W71-00472

8D. Soil Mechanics

LOAD TRANSFER IN EARTH AND ROCKFILL DAMS,
Shannon and Wilson, Inc., Portland, Oreg.
L. Radley Squier.
Proceedings American Society of Civil Engineers, Soil Mechanics Foundation Division, Vol 96, No SM1, p 213-233, Jan 1970. 21 p, 20 fig, 4 tab, 23 ref, append.

Descriptors: Dams, *Earth dams, *Rockfill dams, Instrumentation, Loads (Forces), *Load distribution, Stress concentration, Stress distribution, *Differential settlement, Structural behavior, Soil mechanics, Cracking, Earth pressure, Compressibility, Differential displacements, Settlement (Structural), Strain, Pore pressure, Stress, Bibliographies.
Identifiers: Stress reversal, Arching, Netzahualcoyotl Dam, Mexico, El Infiernillo Dam, Mexico, Arch action, Embankment subsidence.

Instrumentation data obtained from several major rockfill dams revealed that various modes of load transfer and changes in modes may occur in an embankment. Load transfer may influence significantly the characteristics of embankment behavior, settlements and cross-valley displacements, strains, pore-water pressures, and earth pressures. Effects of load transfer on embankment behavior are a function of the stiffness of the core materials in conjunction with the settlement characteristics of the shell materials. Occurrence and effects of load transfer in Mexico's El Infiernillo and Netzahualcoyotl Dams are described. The instrumentation used in the study consisted of inclinometers and crossarms installed during construction of the embankments. Settlement data were expressed in terms of strains or in terms of a percentage of the surface increment of settlement. Changes in strain at depth within certain intervals of time reflected changes in stress. A need exists for greater use of instrumentation of the type which, during construction and post-construction periods, reflects the mass behavior of the various zones comprising the dam. (USBR)
W71-00257

INFLUENCE OF GRAIN ORIENTATION ON DIRECT SHEAR STRENGTH OF A LOESSIAL SOIL,
Rudolph V. Matalucci, Mohamed Abdel-Hady, and John W. Shelton.
Engineering Geology, Vol 4, No 2, p 121-132, Apr 1970. 12 p, 10 fig, 2 tab, 12 ref.

Descriptors: Soil engineering, Soil mechanics, Soil properties, *Shear strength, Soil strength, *Soil structure, Soil tests, Shear tests, Shear planes, Direct shear, Anisotropy, *Loess, Undisturbed samples, Effects.
Identifiers: Failure surfaces.

Direct shear tests were used to evaluate strength anisotropics of undisturbed specimens of Vicksburg loess caused by particle imbrication and azimuthal preferred grain orientation. Average peak shear strength of dry specimens sheared parallel to imbrication was 9% lower than those sheared perpendicular to imbrication. Average peak strength of dry specimens sheared parallel to preferred grain orientation was 12% lower than those sheared perpendicular to grain orientation. For moist specimens the same trend was maintained, but the degree of strength variation was considerably smaller. Failure planes parallel to grain orientation produced off-lapping, short, discontinuous fractures; failure planes normal to grain orientation produced uniform, continuous fractures. Azimuthal preferred grain orientation and particle imbrication were determined from measurements on photomicrographs and by using a dielectric anisotropy instrument. (USBR)
W71-00260

8E. Rock Mechanics and Geology

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-00012

ROCK PROPERTIES AND STEEL TUNNEL LINERS,
California State Dept. of Water Resources, Sacramento.
George H. Kruse.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No P03, p 415-435, June 1970. 21 p, 11 fig, 2 tab, 16 ref, 2 append.

Descriptors: *Steel linings, *Tunnel design, *Tunnel linings, Tunnels, Pressure tunnels, Bibliographies, Liner plates, *Rock properties, Rocks, Water tunnels (Conveyance), Rock mechanics, Design, Stress distribution, Design criteria, Stress analysis, Classification, Deformation, Strain, Relaxation.
Identifiers: Tehachapi Discharge Lines (Calif), Design improvements, Rock pressures, In situ tests, Deformation modulus, Tunnel supports.

The economical design of steel liners for underground pressure tunnels in rock is dependent upon the determination of the properties of the rock envelope and its state of stress. For maximum economy, liner plate thickness is held to a minimum by relying on the load-bearing response of the rock to resist part of the internal hydrostatic pressure while restraining the steel liner at a safe level of strain. A method is presented for evaluating the load-bearing response of the rock around the tunnel, based upon measurement of tunnel convergence (relaxation) during excavation. A system is described for classifying rock along the tunnel and providing appropriate adjustments of linear thickness and reinforcement. A design analysis based on a criterion of steel strain is presented. (USBR)
W71-00269

INSTALLATION, PRESSURIZATION, AND GROUTING OF HYDRAULIC FLAT JACKS IN MORROW POINT POWERPLANT,
Bureau of Reclamation, Denver, Colo.
M. L. Haverland.
Bureau of Reclamation Report REC-OCE-70-19, June 1970. 48 p, 36 fig, 13 tab.

Descriptors: *Underground powerplants, Underground structures, *Rock mechanics, Rocks, Installation, Pressure, Grouting, Calibrations, *Earth movements, Testing, Movement, Piping (Mechanical), Instrumentation, Measurement, *Stabilization.
Identifiers: *Flat jack method, *Jacking, Morrow Point Powerplantcolo), Rock pressures, Underground openings.

Hydraulic flat jacks were installed at strategic locations in the underground excavation for Morrow Point Powerplant, Colo, to provide a reaction against moving rock in a shear zone. Structural behavior monitoring instruments indicated that one rock wall of the underground chamber, located in a shear zone, was slowly moving toward the river. Because construction of the concrete powerplant structure was scheduled for the near future, installing and pressurizing the flat jacks would fill the void caused by concrete shrinkage and provide a known amount of post-stress load. The interior walls and floors would act as load-bearing struts across the powerplant. Twenty flat jacks 96-in. by 16-in. were installed, tested and calibrated, instrumented, pressurized, and grouted. Rock movement stopped while this program was being accomplished, but other remedial measures were in progress at the same time. Which measures had the most effect or whether all worked together to stop the movement cannot be determined. Descriptions of the flat jack installation are included. (USBR)
W71-00274

8F. Concrete

CONCRETE BECKONS POLYMERS.

Chemical Engineering, Vol 77, No 5, p 70-72, Mar 1970. 2 p.

Descriptors: *Concrete technology, *Polymers, *Strength, *Durability, Epoxy resins, Styrenes, Concrete pipes, Impregnation, *Irradiation, Heat, Catalysts, Construction materials, Road construction, Adhesion, *Monomers, Tunnel linings, Costs, Research and development.
Identifiers: *Concrete-polymer materials, *Polymer concretes, Rupture modulus, Polymerization, Bond strength, Brookhaven National Lab.

When polymers are combined with concrete, the resulting composite offers high strength and durability. Polymer addition might even made structural materials of soil or garbage and sewage. The polymer contributes to such properties as strength, durability, and water resistance. A broad range of polymers and monomers are being studied, including methyl methacrylate, polyesters, styrene, epoxies, and nylon. Projects involving concrete are aimed mainly at improving strength. Steel-reinforced concrete panels treated with methyl methacrylate and polymerized increases the modulus of rupture 2-1/2 times. Similarly, pullout strength is increased by a factor of 3 for concrete reinforced with steel bars. Surface impregnation of concrete increases durability. Soil-polymers for building materials and polymers in tunnel walls are discussed. (USBR)
W71-00261

EFFECT OF SAFETY FACTOR AND CONCRETE STRENGTH ON COST OF ARCH DAMS,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 08A.
W71-00272

FIELD AND LABORATORY TESTS FOR SAFETY OF DAMS INVESTIGATION AT SALT RIVER PROJECT, ARIZONA,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
W. G. Austin.
Available from NTIS as PB-191 775, $3.00 in paper copy, $0.95 in microfiche. REC-OCE-70-7, February 1970. 68 p.
Identifiers: *Dams, Safety, *Arizona, Dams, Test methods, Reinforced concrete, Stresses, Loading (Mechanics), Deformation, Construction materials, Drilling, Strain (Mechanics), Rivers, Drilling machines, Salt River Project, Coring.

Survey records indicated that Stewart Mountain and Horse Mesa Dams, San River Project, Ariz., had nonrecoverable displacements exceeding the elastic capability of concrete in order to assess the safety of these dams, the magnitudes of the internal stresses in the concrete under near maximum loading conditions were required. The internal strains were measured in situ by stress relief methods using a borehole deformation gage. A similar program also was conducted on Mormon Flat Dam. Several laboratory tests were performed on the 6-in. extracted cores to obtain physical properties. Laboratory preparations for the field tests, field stress relief tests, and laboratory core tests conducted for the Safety of Dams Program for the Salt River Project are reported.
W71-00466

8G. Materials

DYNAMIC YOUNG'S MODULUS AND FLEXURAL STRENGTH OF SEA ICE,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00043

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03A.
W71-00064

EVALUATION OF A SINGLE LAYERED GRADED GRAVEL AS A PROTECTIVE FILTER,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 04D.
W71-00413

SEEDING OF BRACKISH WATER IN A SPRAY FILM EVAPORATOR,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 03A.
W71-00463

8H. Rapid Excavation

IDEAS FOR PEACEFUL NUCLEAR EXPLOSIONS IN USSR.

International Atomic Energy Agency Bulletin, Vol 12, No 2, p 11-21, 1970. 11 p, 2 fig.

Descriptors: *Nuclear explosions, *Underground explosions, Mining, Underground storage, *Canal construction, *Reservoir construction, Field tests, Safety, Research and development, Foreign research, Seismic properties, Radiation effects, Radioactive contamination, Inter-basin transfers, *Investigations, Construction, Costs, Permafrost.
Identifiers: *Nuclear excavation, USSR, Underground cavities, Gas production, Explosive excavation.

Possible applications of peaceful nuclear explosions in the Soviet economy are reviewed. Scientific research figures prominently in plans for future industrial application of nuclear explosions. Contained blasts and excavation blasts have been investigated. Much work has been done to define fields of application and projects in which nuclear explosions can be used for industrial purposes. Excavation blasts discussed include: reservoir construction, canal construction, and uncovering mineral deposits. Contained blasts discussed include: intensified exploitation of oil and gas deposits; experimental explosions in salt formations; creation of underground cavities for storing natural gas, gas condensates, and oil products; and underground working of ore deposits. (USBR)
W71-00271

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

PROCEEDINGS OF CONFERENCE ON ONGOING WATER RESOURCES RESEARCH IN MINNESOTA, MARCH, 1970.
Minnesota Univ., Minneapolis. Water Resources Research Center.

Available from NTIS as PB-194 783, $3.00 in paper copy, $0.95 in microfiche. Minnesota University Water Resources Research Center Bulletin 21, June 1970. 56 p.

Descriptors: *Water resources research act, *Minnesota, *Universities, Research and development, Training, Data collections, Contracts, Limnology, Water pollution control, Fisheries, Wildlife, Hydraulics, Sedimentation.

On Mar. 26, 1970, a Conference on Ongoing Water Resources Research in Minnesota was sponsored by the Minnesota Water Resources Research Center. The objective of the Conference was to acquaint those concerned with water resources in Minnesota with the nature of ongoing water resources research activities in the State. Representatives from 14 organizations having research programs participated in the Conference. Most of the papers presented at the Conference are published in this Bulletin. (Knapp-USGS)
W71-00163

BOOKS, PUBLICATIONS, PROJECT COMPLETION REPORTS, AND M.S. AND PH.D THESES.
Iowa State Water Resources Research Inst., Ames.

Available from NTIS as PB-195 082, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, June 30, 1970. 68 p. OWRR Project No A-999-1A (2).

Descriptors: *Bibliographies, *Abstracts, *Water resources research act, *Iowa, Water resources, Universities, Research and development, Grants.
Identifiers: Iowa State University.

Books, publications, project completion reports and M. S. and Ph. D. theses related to research program activities supported under Office of Water Resources Research annual allotments and matching grants to the Iowa State Water Resources Research Institute are listed. Information abstracts are also included for most references. (Knapp-USGS)
W71-00344

9D. Grants, Contracts, and Research Act Allotments

REPORT OF THE UNITED STATES DELEGATION TO THE SIXTH SESSION OF THE COORDINATING COUNCIL OF THE INTERNATIONAL HYDROLOGICAL DECADE, UNESCO, GENEVA, SWITZERLAND, JULY 6-11, 1970.
For primary bibliographic entry see Field 06E.
W71-00048

PROCEEDINGS OF CONFERENCE ON ONGOING WATER RESOURCES RESEARCH IN MINNESOTA, MARCH, 1970.
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 09A.
W71-00163

10. SCIENTIFIC AND TECHNICAL INFORMATION

TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7630, p 2079-2088, October 1970. 10 p, 148 ref.

Descriptors: *Translations, *Bibliographies, *Foreign research, *Hydraulics, Flood control, Fluid mechanics, Instrumentation, Documentation, Publications, Streamflow.
Identifiers: Hydraulics literature (Translations).

A bibliography of 148 references is presented of translations of foreign literature on hydraulics. The present list is the second issued since ASCE Manual 35 (1968). This list is an addendum to Manual 35 and is part of the planned revision of the Manual. (Knapp-USGS)
W71-00015

MERCURY BIBLIOGRAPHY,
Eastman Kodak Co., Rochester, N.Y. Kodak Park Div.
For primary bibliographic entry see Field 05A.
W71-00167

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1966-67,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-00173

SELECTED BIBLIOGRAPHY-LOWER MEKONG BASIN.
United Nations Engineer Agency for Resource Inventories, New York.

July 15, 1969. 2 volumes (Vol I, 310 p; Vol II, 223 p).

Descriptors: *Bibliographies, *Water resources, *Resources, Land resources, Human resources, Geology, Geography, Economics, Agriculture, Climates, Fisheries, Education, Electric power, Soils, Mineralogy, Transportation, Forestry, Cities.
Identifiers: Mekong River Basin.

The Selected Bibliography-Lower Mekong Basin of over 3,000 references was prepared as a companion reference work for use with the Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin which was published in September 1968. It is also offered as a research tool that may be used independently of the atlas. The 2 volumes were designed to accommodate change for long-range usefulness of their contents. The loose-leaf style provides the potential for a program of subject category expansion. In main the entries represent material available in the Washington, D. C. area. The file location of each item and additional information not included in the printed bibliography are available at the Engineer Agency for Resources Inventories (United Nations). Within each subject the entries are listed alphabetically by author with single authors preceding joint

or multiple authors, and with title used as main entry when there is no author. Titles by the same author are arranged alphabetically. Some compilations are entered under an editor or title if there are several authors. Entries are given in the language of the original with the exception of those in non-Roman alphabets which are translated or transliterated. (Knapp-USGS)
W71-00229

BOOKS, PUBLICATIONS, PROJECT COMPLETION REPORTS, AND M.S. AND PH.D THESES.
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 09A.
W71-00344

OCEANS IV: A PROCESSING, ARCHIVING AND RETRIEVAL SYSTEM FOR OCEANOGRAPHIC STATION DATA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
For primary bibliographic entry see Field 07C.
W71-00352

MRIS BULLETIN-DEVELOPMENT ISSUE.
National Academy of Sciences-National Research Council, Washington, D.C. Maritime Research Information Service.

National Academy Science, Maritime Research Information Service Bulletin, Summer 1970. 226 p. Maritime Administration Contract MA-4776.

Descriptors: *Bibliographies, *Abstracts, *Information retrieval, *Oceanography, Marine geology, Navigation, Water pollution control, Ships, Computers, Research and development, Transportation.

The Maritime Research Information Service (MRIS) is a system for acquisition, selection, storage, retrieval, and dissemination of references to proposed, ongoing, and completed research and development projects and to technical reports and journal articles in the maritime field. MRIS incorporates concepts and procedures that are compatible with data standards recommended by the Committee on Scientific and Technical Information (COSATI). The MRIS Bulletin is compiled and published from the computer tape records of the Maritime Research Information Service (MRIS). Each issue will contain only that information acquired since the previous issue, and an annual consolidated bulletin will be compiled containing all selections for the preceding year. Selections for this publication are made by the MRIS professional staff and include unclassified-unlimited contributions from the Maritime Administration, U. S. Department of Commerce; Science Information Exchange (SIE); Engineering Index (EI); National Technical Information Service (NTIS); Department of Defense (DOD); National Aeronautics and Space Administration (NASA); Atomic Energy Commission (AEC); Transportation Research Information Service of the National Academy of Sciences (TRIS); and Joint Publications Research Service (JPRS). Three indexes are provided, as follows: (1) Subject Term Index; (2) Author/Investigator Index; and (3) Publisher/Performing Organization Index. (Knapp-USGS)
W71-00395

SPATIAL SURVEILLANCE OF NATURAL RESOURCES,
Royal Aircraft Establishment, Farnborough (England).
For primary bibliographic entry see Field 07B.
W71-00452

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U.S. Geological Survey - Hydrology	W71-00001--00052 00054--00055 00057--00061 00063--00070 00163--00164 00166--00205 00207--00212 00214--00229 00304--00308 00344--00350 00352--00398 00402--00406 00400	196
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University of Wisconsin - Eutrophication	W71-00099--00105 00107--00108 00110--00118 00097	19
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University of Arizona - Arid Lands Water Resources	W71-00144--00146 00148--00161 00165	18
Vanderbilt University - Thermal Pollution	W71-00231--00233 00235--00237 00245--00255 00242	18
Bureau of Reclamation - Engineering Works	W71-00257--00265 00267--00274	17
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University of Chicago - Metropolitan Water Resources Management	W71-00310--00313 00315--00324	14
Iowa State University - Agricultural Livestock Wastes	W71-00325--00327 00329--00343	18
University of Washington - Water Quality Requirements for Aquatic Organisms	W71-00303	1

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University of Florida - Eastern U.S. Water Law	W71-00487--00550 00053, 00056 00062, 00079 00074--00076 00081--00096 00098, 00106 00109, 00126 00206, 00213 00234, 00256 00238--00241 00243, 00244 00266, 00278 00279, 00300 00309, 00314 00328, 00351 00399, 00401 00419, 00425 00426, 00432 00439, 00444 00147, 00162	119
B. State Water Resources Research Institutes		
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Illinois Water Resources center	W71-00470--00472	3
Mississippi Water Resources Research Institute	W71-00473	1
C. Other		
Federal Water Quality Administration	W71-00407--00412 00475--00480	12
Engineering Aspects of Urban Water Resources (Herbert G. Poertner)	W71-00483--00486	4
Office of Saline Water	W71-00481--00482	2

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWQA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Federal Water Quality Administration in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

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3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

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